

Water Use Characteristics



3.1 INTRODUCTION

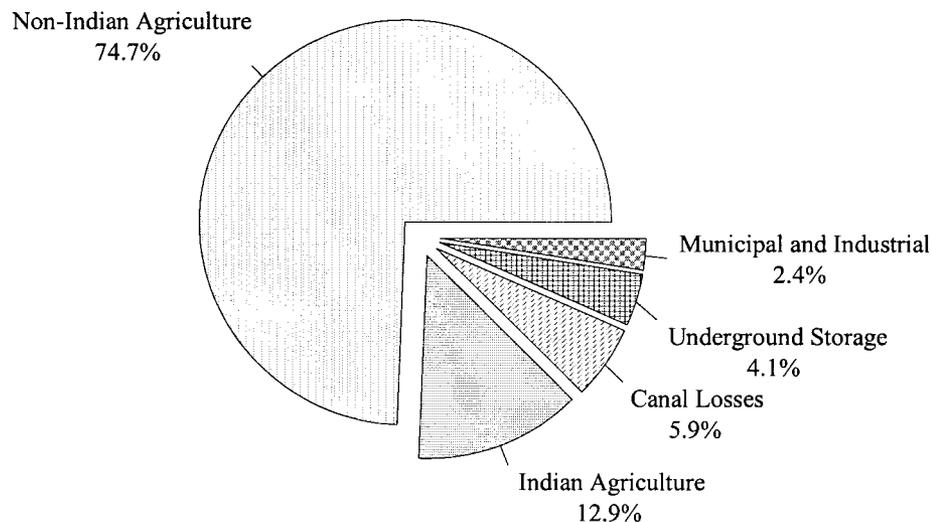
This chapter is concerned with the water use characteristics of the Pinal Active Management Area (AMA) for the agricultural, municipal, and industrial sectors. The chapter consists of three sections: (1) an overview of supply and demand trends, (2) the baseline water budget, and (3) factors that may influence future groundwater use.

The Pinal AMA includes portions of Pinal, Maricopa, and Pima counties. The 1995 population of the AMA was 87,692. The majority of the population, nearly 60 percent, lived within the AMA's four incorporated municipalities, with the balance of the population living in small, unincorporated communities and on isolated farms and ranches.

3.2 OVERVIEW OF SUPPLY AND DEMAND TRENDS

This section describes current and historical water use of the agricultural, municipal, and industrial sectors of the Pinal AMA. Water demand in the AMA has been historically driven by the agricultural sector. Since the 1980s, water use by non-Indian agriculture, Indian agriculture, and agricultural canal losses have together accounted for about 95 to 98 percent of the AMA's total annual water demand. In 1995, non-Indian agricultural water use was 844,207 acre-feet, or 74.7 percent of the AMA's total demand of 1,129,723 acre-feet. Indian agriculture used approximately 145,510 acre-feet, or 12.9 percent of the total demand, and canal losses totaled 66,211 acre-feet, or 5.9 percent of the total demand. Municipal and industrial water uses together accounted for 26,812 acre-feet, or approximately 2.4 percent the total demand, and underground storage totaled 46,983 acre-feet, or about 4.1 percent of the total demand. Figure 3-1 illustrates the significance of agricultural water use within the AMA.

**FIGURE 3-1
1995 WATER USE BY SECTOR
PINAL ACTIVE MANAGEMENT AREA**



3.2.1 Agricultural

In the early 1980s, the Arizona Department of Water Resources (Department) issued Certificates of Irrigation Grandfathered Rights (IGFRs) to non-Indian farmers in AMAs if they had irrigated two or more acres of farmland between 1975 and 1980. For each IGFR, the Certificate designates the number of irrigation acres allowed to be irrigated on the farm. With few exceptions, no new farmland greater than

two acres in size can be irrigated within an AMA. In 1994, legislation removed the conservation requirements for IGFRs that were ten acres or less in size, provided they were not part of an integrated farming operation. All other IGFRs are still regulated and subject to conservation requirements, which are in described in Chapter 4.

Approximately 87 percent of the irrigation acreage within the non-Indian portion of the Pinal AMA is served by four large irrigation and drainage districts: Central Arizona (CAIDD), Maricopa-Stanfield (MSIDD), Hohokam (HIDD), and San Carlos (SCIDD). Figure 3-2 shows the location of the irrigation acreage within the AMA, while Figure 3-3 shows the location of the four irrigation districts. Groundwater is pumped to supplement deliveries of Central Arizona Project (CAP) water in CAIDD, MSIDD, and HIDD and surface water in SCIDD in order to fulfill demands up to the total amount of water allotted annually to the farms in each district. SCIDD receives and distributes surface water from the Gila River pursuant to the Globe-Equity Decree.

Farms outside of the four irrigation districts are almost totally dependent on groundwater supplies. Their use of groundwater is closely related to the cyclic nature of the agricultural economy and the cost of pumping groundwater. These farms account for about 12 percent of the non-Indian irrigation acreage within the Pinal AMA.

In addition, there are six small irrigation districts in the Pinal AMA that distribute groundwater to small farms. These farms account for less than one percent of the AMA's non-Indian irrigation acreage.

Prior to 1987 when the Central Arizona Water Conservation District (CAWCD) began delivering CAP water to the agricultural sector, water demands were largely met by groundwater and by surface water diverted from the Gila River. On average, non-Indian agricultural water demand in the Pinal AMA prior to the completion of the CAP was satisfied by 76 percent groundwater and 24 percent surface water. Since 1987, CAP water deliveries have reduced the overall dependence on groundwater pumping by non-Indian agriculture by about one-third. Groundwater pumping from 1987 through 1995 has satisfied 51 percent of the water demand of non-Indian agriculture. The remaining demand was satisfied by CAP water (24 percent), in-lieu groundwater (8 percent), and Gila River water (17 percent). Figure 3-4 shows the different types of water that have been historically used to satisfy the non-Indian agricultural water demand of the AMA.

The Pinal AMA has a diverse agricultural economy. Farmers grow many different crops, including cotton, small grains (wheat and barley), alfalfa, and such speciality crops as pecans, grapes, and miscellaneous vegetables. The climate is hot and dry during the summer months, resulting in high irrigation demands because of the high evapotranspiration (ET) rates of crops grown during that time of year.

3.2.1.1 Non-Indian Agriculture

Within the three CAP irrigation districts, groundwater dependency has been significantly reduced since CAP water supplies became available in the mid 1980s. CAP districts that control groundwater wells are managing withdrawals to ensure the lowest overall cost of water for their customers. In addition, groundwater is used to irrigate excess lands as defined by the federal Reclamation Reform Act (RRA), to provide a back-up supply during CAP outages, and to routinely supply water to areas where CAP water cannot be delivered. Since 1990, groundwater deliveries have represented about 42 percent of total water use in the CAP districts.

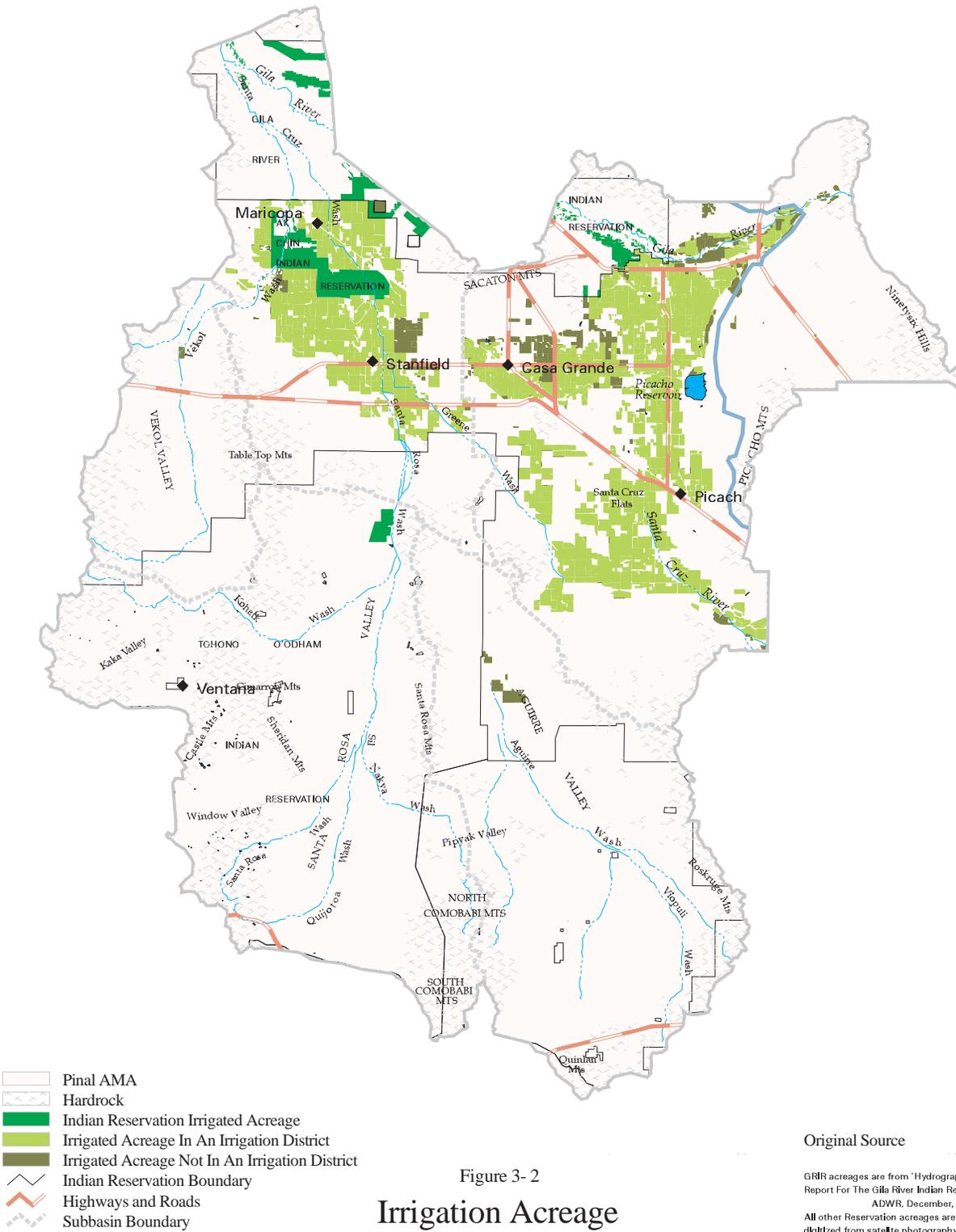
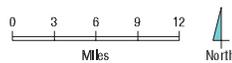


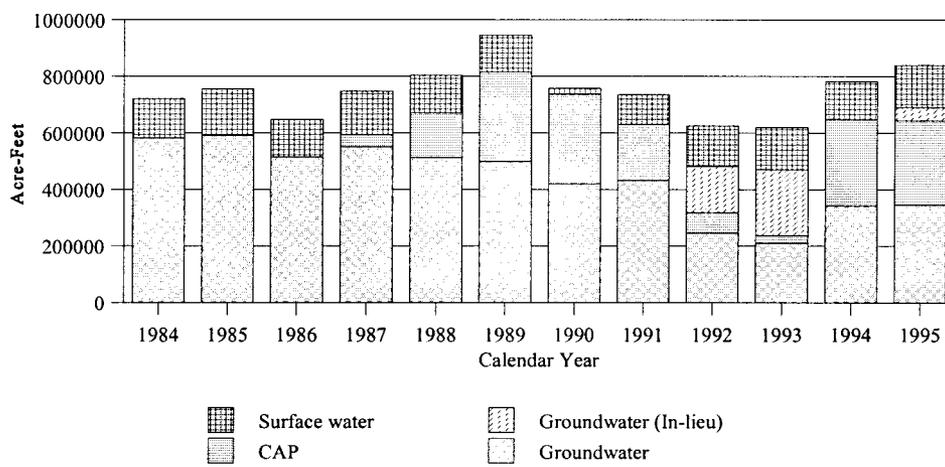
Figure 3-2
Irrigation Acreage

Original Source

GRR acrages are from 'Hydrographic Survey Report For The Gila River Indian Reservation ADWR, December, 1996 All other Reservation acrages are digitized from satellite photography



**FIGURE 3-4
NON-INDIAN AGRICULTURAL WATER USE
1984-1995
PINAL ACTIVE MANAGEMENT AREA**



3.2.1.1.1 Maricopa-Stanfield Irrigation and Drainage District

MSIDD was organized in 1962 to obtain supplemental water from the CAP. MSIDD is composed of approximately 87,200 acres and, since 1987, typically has required about 234,000 acre-feet of irrigation water annually, about 45 percent of which was CAP water. Construction of the district's distribution system was completed in 1989. The district operates the Santa Rosa Canal, 78 miles of main conveyance canals, 116 miles of lined lateral canals and pipelines, 197 farm turnouts, and 484 irrigation wells. The turnout system is totally automated and controlled from district headquarters, which is located approximately halfway between the unincorporated communities of Maricopa and Stanfield. Cotton, small grains, alfalfa, pecans, grapes, and other specialty crops are grown within the district.

MSIDD leases the wells from its landowners and controls the operation of the wells. Landowners receive tax incentives from the district in lieu of lease payments. Of the 410 wells in the district, only 80 are directly connected to the district's distribution system. The remaining wells are operated in order to supply individual farms with groundwater to supplement CAP water deliveries.

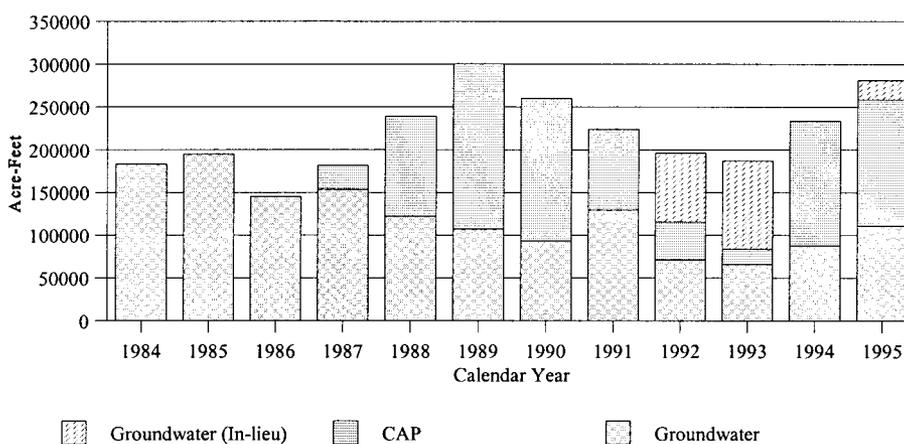
The district charges a uniform rate and a seasonal rate for irrigation water. In 1995, the uniform rate was \$42.50 per acre-foot. Water pricing incentives were offered during the seasonal months in 1995, lowering the price to \$27.00 per acre-foot from January to April and \$30.00 per acre-foot from October to December. Lands that were not in compliance with the RRA acreage limitations were charged an additional \$4.00 per acre-foot for water.

3.2.1.1.1.1 Historic Water Use

Groundwater use has generally declined since MSIDD began delivering CAP water in 1987. After completion of the district's distribution system, CAP water usage peaked in 1989 and 1990. This peak was largely a result of the initial low price charged by CAWCD for CAP water. As CAP water prices began to rise in 1991, CAP utilization began to drop. In 1992, CAWCD created its in-lieu (indirect) recharge program to increase deliveries of agricultural CAP water. Under this program, the price charged by CAWCD for in-lieu recharge water (in-lieu groundwater) was \$13.00 per acre-foot, compared approximately \$38.00 per acre-foot for agricultural CAP water. This significant difference in price was a major factor in overall CAP usage climbing to higher levels in 1992 and 1993. In 1994, CAWCD

discontinued its in-lieu recharge program in favor of an incentive pricing program to encourage greater CAP use. This new program called "target pricing" created three pools of agricultural CAP water. Pool 1 and pool 2 each contain 200,000 acre-feet of water. The amount in pool 3 is not capped. Pool 1 was initially priced at \$27.00 per acre-foot, pool 2 at \$17.00 per acre-foot, and pool 3 at \$41.00 per acre-foot. CAWCD's target pricing program is scheduled to continue through 2003, with the price of pool 1 and pool 2 increasing at a rate of \$1.00 per acre-foot per year. Since the inception of the target pricing program, MSIDD has purchased all of the pool 1 and 2 supplies available to the district. In 1995, groundwater usage amounted to 110,910 acre-feet, CAP water usage totaled 147,557 acre-feet, and in-lieu groundwater amounted to 22,942 acre-feet. Figure 3-5 illustrates annual water use for MSIDD since 1984.

**FIGURE 3-5
MARICOPA-STANFIELD IRRIGATION AND DRAINAGE DISTRICT
AGRICULTURE WATER USE
1984-1995
PINAL ACTIVE MANAGEMENT AREA**



3.2.1.1.2 Water Use Patterns and Trends

The water use patterns and trends in MSIDD are significantly tied to agricultural economics and regulations. When crop commodity prices are low, there is a corresponding reduction in the amount of acreage planted in the district. The cost of water also plays a significant role in the total water demand of the district. The district minimizes overall water costs to its customers by fully utilizing its least expensive sources of water. MSIDD has historically maximized its use of low cost hydroelectric power to pump groundwater and has also utilized less expensive CAP indirect recharge supplies and CAP pool water before purchasing regularly priced CAP water. In addition to economics, the district has had to pump groundwater during CAP outages and to meet restrictions imposed by the RRA on deliveries of CAP water to excess lands. Table 3-1 shows the land and water utilization rates in MSIDD since 1989. For the period 1989-1995, the average water utilization rate in the district was 4.56 acre-feet per acre.

3.2.1.1.2 Central Arizona Irrigation and Drainage District

CAIDD was organized in 1964 to obtain supplemental water from the CAP. CAIDD is composed of approximately 87,000 acres and has typically required about 168,000 acre-feet of irrigation water annually from 1987 to 1995, about 41 percent of which was CAP water. Construction of the district's distribution system was completed in 1990. The distribution system has three CAP turnouts, 32 miles of main canals, and 208 miles of laterals and pipe. All of the district's canals and laterals are concrete lined. The turnout system is totally automated and controlled from district headquarters in Eloy. The primary crops grown within the district are cotton, small grains, pecans, citrus, and other specialty crops.

CAIDD leases 368 wells from district landowners. In any given year, the district operates approximately 200 of these wells. District landowners receive lease payments from the district for the use of their wells.

The district charges a uniform rate for irrigation water. In 1995, the rate was \$39.00 per acre-foot. Lands that were not in compliance with the RRA were charged an additional \$4.01 per acre-foot.

**TABLE 3-1
MARICOPA-STANFIELD IRRIGATION AND DRAINAGE DISTRICT
LAND AND WATER UTILIZATION RATES, 1989-1995
PINAL ACTIVE MANAGEMENT AREA**

MSIDD		1989	1990	1991	1992	1993	1994	1995
Land Utilization	Acres	60,000	61,000	49,000	43,500	35,000	54,500	66,000
	% Total Land	69	70	56	50	40	63	76
Water Utilization	% Groundwater	36	36	58	36	35	37	39
	% Groundwater (In-lieu)	0	0	0	41	56	0	8
	% CAP Water	64	64	42	23	9	63	53

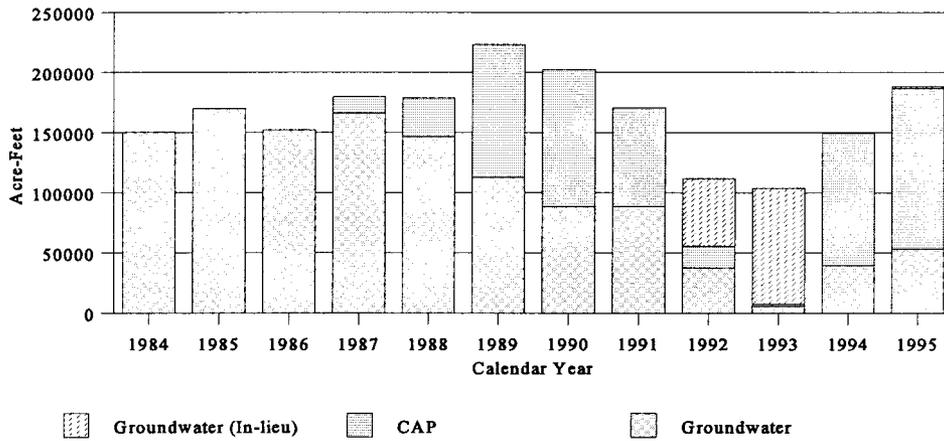
3.2.1.1.2.1 Historic Water Use

Since CAP water became available, groundwater use in CAIDD has been significantly curtailed. Prior to the availability of CAP water, the district used, on average, 157,000 acre-feet of groundwater annually to meet the needs of its customers. After completion of the district's distribution system in 1990, average annual groundwater use declined to 52,000 acre-feet per year. Similar to MSIDD, CAIDD took advantage of CAWCD's indirect recharge program in 1992 and 1993. In 1993, the district received more than 96,000 acre-feet of in-lieu groundwater, 1,426 acre-feet of regular CAP water, and pumped just 5,830 acre-feet of groundwater. With the onset of CAWCD's target pricing program in 1994, CAIDD purchased most of the pool 1 and pool 2 supplies made available to it. In 1995, farms in CAIDD used 53,034 acre-feet of groundwater, 133,949 acre-feet of CAP, 1,615 acre-feet of in-lieu groundwater, 1,480 acre-feet of surface water diverted from the Santa Cruz River, and 280 acre-feet of effluent. The 1995 CAIDD water use includes deliveries made to the San Lucey Farm, which is owned by the Tohono O'odham Nation (see section 3.2.1.2). Figure 3-6 shows annual water use for CAIDD since 1984.

3.2.1.1.2.2 Water Use Patterns and Trends

Since the early 1990s, CAIDD landowners have experienced serious economic and financial problems due to low commodity prices, high water costs, and high district assessments. Many landowners had difficulty paying their assessments. As a result, in August 1994, the district filed for bankruptcy under Chapter 9 of the Bankruptcy Code. Due to these problems, the planted acres within the district were severely reduced as compared to the early to mid 1980s. Since 1994, land utilization within the district has been increasing. This increase can be attributed to the improved agricultural economy and the recent bankruptcy agreement with the United States which provided for a restructuring of the district's debt. The agreement sets a repayment schedule, limits groundwater pumping, and gives CAIDD repayment credits for purchase and extinguishment of flex account credits. Table 3-2 shows land and water utilization for the district since 1990. The district utilized water at an average rate of 4.03 acre-feet per acre for the period of 1990 to 1995.

**FIGURE 3-6
CENTRAL ARIZONA IRRIGATION AND DRAINAGE DISTRICT
AGRICULTURE WATER USE
1984-1995
PINAL ACTIVE MANAGEMENT AREA**



**TABLE 3-2
CENTRAL ARIZONA IRRIGATION AND DRAINAGE DISTRICT
LAND AND WATER UTILIZATION RATES, 1990-1995
PINAL ACTIVE MANAGEMENT AREA**

CAIDD		1990	1991	1992	1993	1994	1995
Land Utilization	Acres	48,000	40,000	32,000	26,000	36,500	47,200
	% Total Land	55	46	37	30	42	54
Water Utilization	% Groundwater	44	52	34	6	26	28
	% Groundwater (In-lieu)	0	0	50	93	0	1
	% CAP Water	56	48	16	1	74	71

Since 1990, planted acreage in CAIDD has averaged 44 percent of the district's total acreage. During that same period, the district satisfied 68 percent of its total water demand with CAP water. Similar to MSIDD, CAIDD minimizes overall consumer water costs by fully utilizing its least expensive sources of water. On average, incentive priced CAP water supplies have been less expensive than groundwater pumped by the district.

3.2.1.1.3 Hohokam Irrigation and Drainage District

HIDD was formed in 1972 to contract the construction, operation, and maintenance of a distribution system to deliver CAP water to district agricultural interests. HIDD is composed of about 26,600 acres and, since 1988, has typically required approximately 94,000 acre-feet of irrigation water annually, about 21 percent of which was CAP water. The district began delivering CAP water in 1988, and construction of its distribution system was completed in 1989. District landowners retain control of their wells, using CAP water to supplement pumped groundwater. The district operates three CAP pump stations and four pump

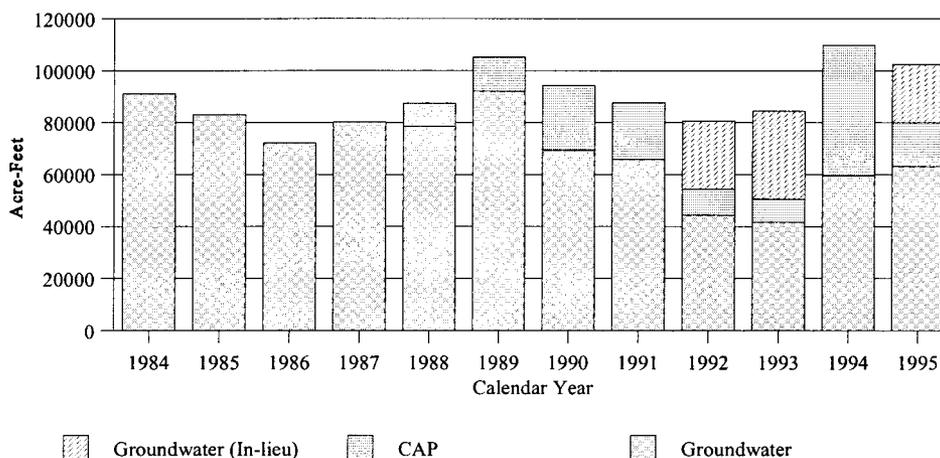
turnouts, and the distribution system has 15 miles of lined main canals and 70 miles of lined laterals and pipelines. The district's headquarters are located in Coolidge. Crops grown in the district include cotton, small grains, alfalfa, and melons.

HIDD charges a uniform rate for CAP water, which has ranged from \$30.00 to \$35.00 per acre-foot. Historically, winter rates have been \$10.00 or less per acre-foot to encourage additional CAP utilization.

3.2.1.1.3.1 Historic Water Use

From 1984 through 1993, total water use in HIDD was generally consistent, averaging about 87,000 acre-feet annually. Total water use in 1994, however, was 109,619 acre-feet, which represented the largest annual water use in the district's history. In 1995, HIDD utilized 63,044 acre-feet of groundwater, 17,030 acre-feet of CAP water, and 22,426 acre-feet of in-lieu groundwater. It is believed that this large spike in water use was due to the increased cotton acreage that was planted to take advantage of the rebounding agricultural economy. In addition, crop ET rates were above average that summer due to record heat and below normal precipitation. Figure 3-7 illustrates annual water use for HIDD since 1984.

**FIGURE 3-7
HOHOKAM IRRIGATION AND DRAINAGE DISTRICT
AGRICULTURAL WATER USE
1984-1995
PINAL ACTIVE MANAGEMENT AREA**



3.2.1.1.3.2 Water Use Patterns and Trends

Annual water use in HIDD from 1984 through 1993 remained relatively constant. During this period, planted acreage in the district ranged from 67 to 75 percent of the district's total acreage. Beginning in 1994, land utilization in the district increased to very high levels (approaching 95 percent) because of the revitalized agricultural economy. The demand for water in 1994 and 1995 either closely matched or surpassed historic water use trends over the past ten years. Table 3-3 shows the water utilization rates since 1988. The district utilized water at an average rate of 4.41 acre-feet per acre of water during the 1988 to 1995 time period.

Until 1994, groundwater use in HIDD generally showed a steady decline as a result of increased CAP deliveries. The increase in groundwater use in the district in 1994 and 1995 was due to the higher than normal water demand brought about by the increased level of planting and the lack of sufficient and affordable renewable water supplies, such as CAP.

**TABLE 3-3
HOHOKAM IRRIGATION AND DRAINAGE DISTRICT
WATER UTILIZATION RATES, 1988-1995
PINAL ACTIVE MANAGEMENT AREA**

HIDD		1988	1989	1990	1991	1992	1993	1994	1995
Water Utilization	% Groundwater	90	88	74	75	55	49	54	62
	% Groundwater (In-lieu)	0	0	0	0	33	40	0	22
	% CAP Water	10	12	26	25	12	11	46	16

3.2.1.1.4 San Carlos Irrigation and Drainage District

The Ashurst-Hayden Diversion Dam was authorized by an act of Congress in 1916 and was known as the Florence-Casa Grande Irrigation Project. The act also approved the construction of a delivery system to deliver water to systems irrigating 35,000 acres of Indian land and 27,000 acres of private land.

In 1924, the San Carlos Irrigation Project (SCIP) was authorized by an act of Congress. The act provided that Coolidge Dam be constructed, that an irrigation district be formed under state law, and that an appropriate repayment contract be executed by the district. This act established the water rights for district and project lands in the name of the United States.

An act of Congress in 1928 authorized development of electric power at Coolidge Dam and authorized the consolidation of the Florence-Casa Grande Irrigation Project with SCIP. The "new" SCIP included 100,000 acres of land.

SCIDD was organized in 1928. A repayment contract was executed in 1931, under which district landowners were obligated to repay the federal government one-half of all project construction costs. SCIDD includes 50,000 acres of private and public lands within SCIP.

Although the total irrigable area in SCIDD is about 50,000 acres, only about 45,000 acres have IGFRs. Surface water is the main water source for the district. Surface water supplies come from the San Carlos Reservoir behind Coolidge Dam, which captures the natural flow of the Gila River. Other sources of supply used to meet district water requirements have included groundwater underlying district lands, and interim CAP water.

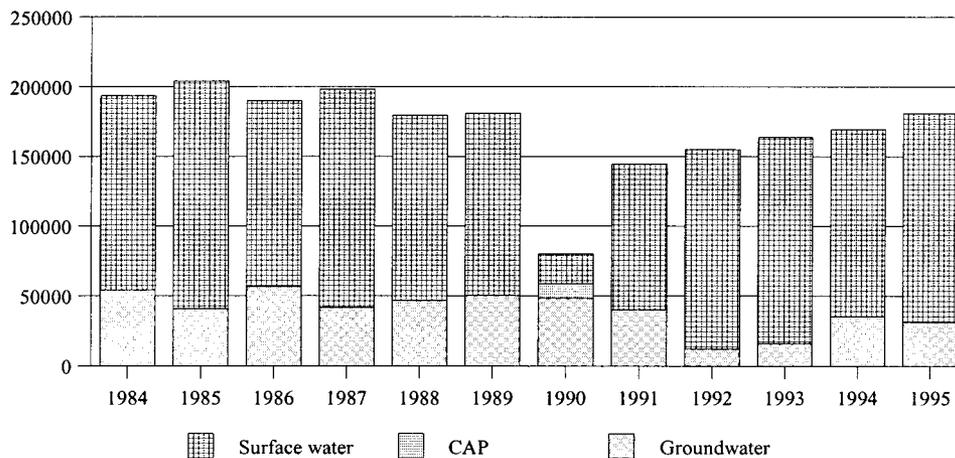
SCIDD's distribution system is 205 miles of earthen (unlined) main and lateral district-owned canals, and 40 miles of jointly-owned (with SCIP) canals, of which only two miles are lined. The district, whose headquarters are located in Coolidge, has expressed an interest in lining its lateral canals to better manage deliveries to its customers. The crops typically grown in the district are cotton, small grains, alfalfa, melons, grain sorghum, and pasture. Annually, only about 34,500 acres are actually planted.

The annual assessment paid by SCIDD landowners covers repayment of distribution system construction costs and district operation and maintenance costs. Payment of the assessment entitles the landowner to two acre-feet per acre if water is available. The assessment was \$56.00 per acre in 1995. A charge of \$20.00 is made for each additional acre-foot delivered.

3.2.1.1.4.1 Historic Water Use

Total water usage from 1984 through 1995 was reported to be 2,039,504 acre-feet. During this time period, SCIDD supplemented its surface water deliveries with 474,493 acre-feet of groundwater. In 1990, an extreme drought on the Gila River watershed prohibited the delivery of normal amounts of surface water to district landowners, severely curtailing planted acreage. Even with the reduced acreage, SCIDD accepted delivery of 10,301 acre-feet of interim CAP water to help the United States Bureau of Reclamation meet minimum pool requirements in the San Carlos Reservoir to avoid a massive fish kill. Excluding 1990, the average annual water use for the district during this period was approximately 178,129 acre-feet, of which 21.7 percent (38,731 acre-feet) was groundwater. In 1995, farms in SCIDD used 31,472 acre-feet of groundwater, 149,616 acre-feet of surface water, 1,041 acre-feet of effluent, and 97 acre-feet of industrial wastewater. Though SCIDD did not utilize CAP water in 1995, 135 acre-feet of CAP water was delivered to a farm within the district on an interim basis. Because the district's distribution system is unlined, it annually has experienced high amounts of lost and unaccounted for water, averaging 42 percent over a six-year period from 1988 through 1993. Figure 3-8 shows annual water use for SCIDD since 1984. It should be noted that because of the small amounts of effluent and industrial wastewater used by SCIDD, they are not included in the graph.

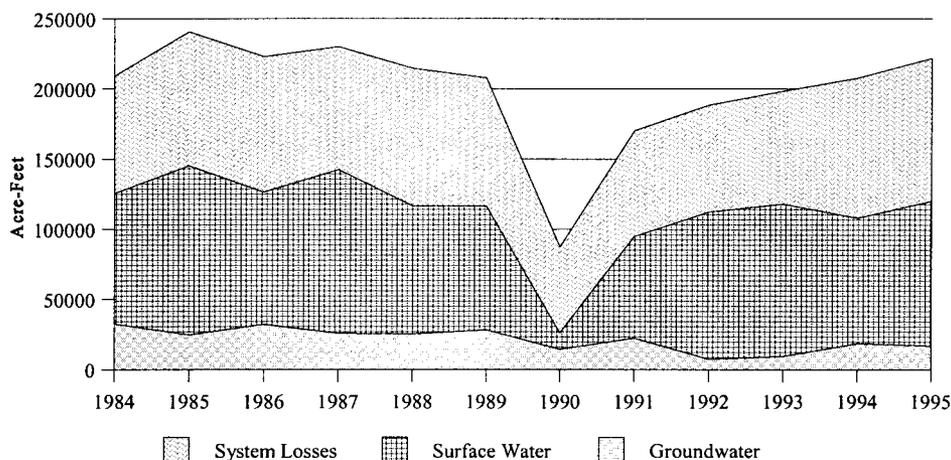
**FIGURE 3-8
SAN CARLOS IRRIGATION AND DRAINAGE DISTRICT
AGRICULTURAL WATER USE
1984-1995
PINAL ACTIVE MANAGEMENT AREA**



3.2.1.1.4.2 Water Use Patterns and Trends

With the exception of 1990, SCIDD has had fairly consistent level of planted acreage and water use since 1984. The average rate of water utilization in the district for the time period of 1984 to 1995 was 4.93 acre-feet per acre. Reported deliveries to farms when compared to the crops planted indicate that the overall farm irrigation efficiency on a district-wide basis exceeds 100 percent. This inflated irrigation efficiency level can be attributed to the high lost and unaccounted for water claimed by the district. Studies of unlined canals similar to those in the district have shown that typical losses due to seepage and crop demand are in the neighborhood of 15 to 20 percent. Using these values for comparative purposes, approximately one-half of the lost and unaccounted for water claimed by the district is, in fact, being delivered and used to meet crop demands. Figure 3-9 illustrates the large amount of losses that SCIDD has attributed to its unlined canal system.

**FIGURE 3-9
SAN CARLOS IRRIGATION AND DRAINAGE DISTRICT
WATER USE AND SYSTEM LOSSES PER YEAR
1984-1995
PINAL ACTIVE MANAGEMENT AREA**



3.2.1.1.5 Non-District Farms

Approximately 34,000 acres of the farmland within the non-Indian portion of the Pinal AMA are not served by an irrigation district. Non-district farms rely almost entirely on groundwater pumped from individual, private wells. A few farms also use effluent delivered to them from nearby municipal wastewater treatment plants. Crops historically grown are cotton, small grains, alfalfa, and pasture.

3.2.1.1.5.1 Historic Water Use

Water use on non-district farms peaked in 1989. From 1990 through 1993, groundwater usage declined due to reduced planted acreage resulting from the poor agricultural economy. In late 1993, the crop commodity prices began to rebound, leading to more cotton being planted in 1994. This increased planting along with the hot and dry climatic conditions that summer caused a spike in groundwater use. In 1995, groundwater usage dropped to 1992 and 1993 levels. Non-district farms used 87,155 acre-feet of groundwater and 2,856 acre-feet of effluent in 1995. Figure 3-10 shows annual water use by non-district farms since 1984. It should be noted that because of the small amount of effluent used by non-district farms, it is not included in the graph.

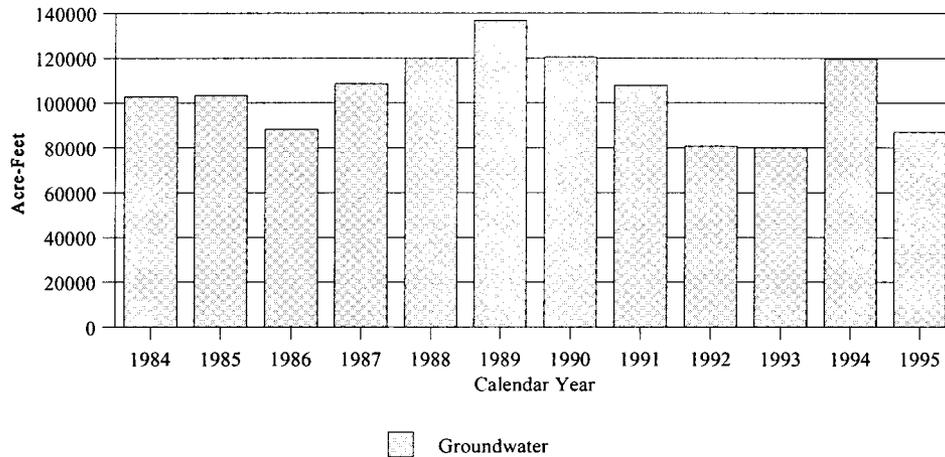
3.2.1.1.5.2 Water Use Patterns and Trends

Water use patterns by non-district farms since 1984 have been closely tied to the agricultural economy and climatic conditions. It is anticipated that future water use will also be dependent on these factors. Since 1984, average annual water use has been roughly 104,500 acre-feet. No data are available regarding planted acreage by non-district farms.

3.2.1.1.6 Small Irrigation Districts

Six small irrigation districts in the Pinal AMA deliver water via pipeline and, in most cases, meter the deliveries to each farm. Typically, water deliveries are to small farms, or ranchettes, of ten acres or less. In combination, these small irrigation districts serve approximately 1,400 acres. In July 1994, the Small Rights Bill (House Bill 2237) became effective. Farms in AMAs that are ten acres or less in size are

**FIGURE 3-10
NON-DISTRICT AGRICULTURAL WATER USE
1984-1995
PINAL ACTIVE MANAGEMENT AREA**



generally no longer required to measure and report their water use or pay groundwater withdrawal fees. However, an irrigation district must still report the total water deliveries to such farms.

3.2.1.2 Indian Agriculture

Indian communities are major agricultural water users in the Pinal AMA. The Ak-Chin Indian Reservation and portions of both the Gila River and Tohono O’odham Indian Reservations are located within the AMA. In 1986, the United States Bureau of Indian Affairs and tribal officials reported that 15,531 acres were irrigated within the AMA, with 58 percent of all irrigation water being groundwater. In contrast, the total amount of Indian irrigated acreage within the AMA in 1995 was estimated to be 29,922 acres, with only 19 percent of all irrigation water being groundwater. The balance was mostly supplied by surface water diverted from the Gila River by SCIP and CAP water. Relatively small amounts of effluent and other surface water supplies were also used. The nearly 100 percent increase in irrigated acreage on Indian lands since 1986 is mostly attributable to the increased agricultural development on the Ak-Chin Indian Reservation. Table 3-4 shows the amount of acreage irrigated in 1986 and 1995 for each Indian community and the types and amounts of water used. In 1995, Indian agriculture used 28,163 acre-feet of groundwater, 41,002 acre-feet of surface water and effluent, and 76,345 acre-feet of CAP water. The location of the Indian irrigated acreage is shown in Figure 3-2.

**TABLE 3-4
INDIAN IRRIGATED ACREAGE AND WATER USE, 1986 AND 1995
PINAL ACTIVE MANAGEMENT AREA**

Indian Community	1986 Acreage	Type of Water Used			1995 Acreage	Type of Water Used		
		GW	SW	CAP		GW	SW	CAP
Gila River	9,756	17,287	35,688	0	10,350	15,199	41,002	0
Ak-Chin	5,035	28,783	0	0	16,597	0	0	76,345
Tohono O'odham	740	4,230	0	0	2,975	12,964	0	0
TOTAL	15,531	50,300	35,688	0	29,922	28,163	41,002	76,345
% of TOTAL	-----	58	42	0	-----	19	28	53

GW = groundwater

SW = surface water (also includes some effluent)

3.2.2 Municipal

Municipal water use includes all non-irrigation uses of water supplied by a city, town, private water company, or irrigation district. Incorporated towns and cities are defined as municipalities. A private water company is an individually-owned or corporately-owned entity that distributes or sells groundwater and is regulated by the Arizona Corporation Commission (ACC). The Department also regulates the following entities as private water companies: homeowners associations; cooperatives; and large institutional facilities such as schools, prisons, and government installations served by privately owned wells. Irrigation districts regulated under the municipal conservation program are typically entities that provide untreated water for non-agricultural uses. All municipal water providers are subject to conservation requirements, which are described in Chapter 5.

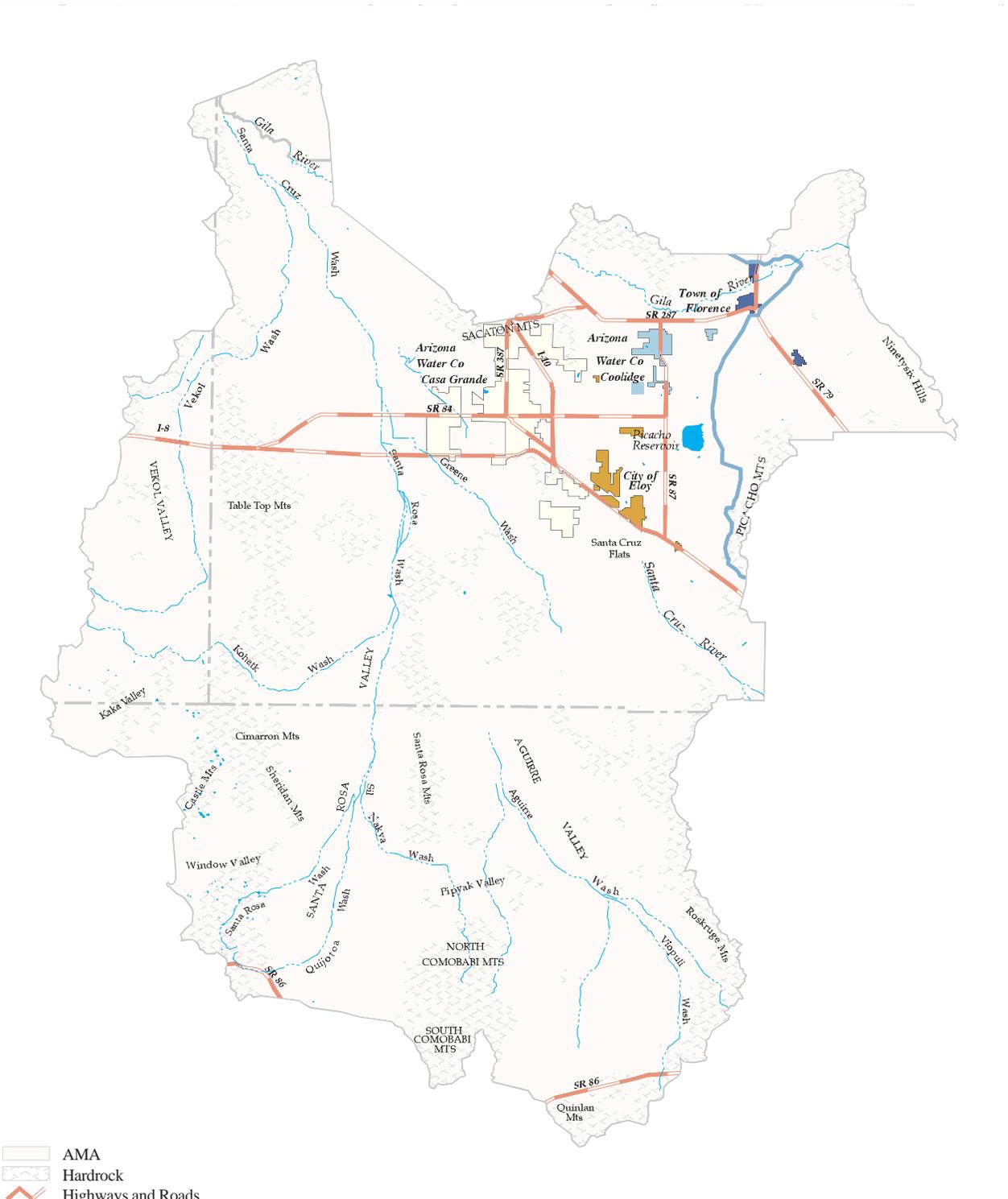
Municipal water use includes water delivered to residential customers for indoor and outdoor watering. Water delivered to non-residential users such as industrial facilities, commercial properties, construction users, and individual users is also categorized as municipal water use. Individual users include turf-related facilities, landscaped public rights-of-way, and large-scale cooling facilities that are served water by a municipal system which have been identified as having high water use rates, significant conservation potential, or high visibility within the service area.

In 1995, municipal water demand in the Pinal AMA totaled 21,115 acre-feet. This figure includes pumpage by exempt domestic wells (wells that pump 35 gallons per minute or less). From the 1,314 exempt wells in the AMA, the Department assumed an average use of one acre-foot per year, which would account for 1,314 acre-feet of groundwater. Municipal use by Indian communities was also included in the baseline municipal use. Population among the AMA portions of Indian communities was 7,907 in 1995. It was assumed that each Indian domestic well annually used one acre-foot of water, and that there was a well for every seven people. These domestic uses contributed to a total municipal groundwater demand of 19,660 acre-feet. The balance of municipal water demand, 1,455 acre-feet, was met with renewable water supplies (558 acre-feet of surface water, 835 acre-feet of CAP water, and 62 acre-feet of effluent), which were used for turf and landscape watering purposes. The municipal sector accounted for approximately two percent of the total water demand for the AMA in 1995.

3.2.2.1 Large Municipal Providers

In the Pinal AMA, there are four large municipal providers (providers that serve over 250 acre-feet per year to cities and towns). Two of the large providers are municipalities and two are private water companies. In 1995, large providers served approximately 58 percent of the AMA population and provided 61 percent of the total water used for residential, industrial, construction, and commercial uses. All four large providers have CAP allocations that they intend to use to meet future municipal demands. The fact that these providers serve relatively small communities and lack the financial resources to develop the infrastructures necessary for using CAP water, make it extremely difficult to switch water supplies in the near future. Providers with CAP allocations are seeking alternative arrangements with replenishment and augmentation authorities to facilitate the use of their CAP allocations in-lieu of using groundwater. Figure 3-11 shows the location of the large municipal providers in the AMA.

The overall average Gallons Per Capita per Day (GPCD) rate for large municipal providers in the Pinal AMA between 1985 and 1996 was 223 GPCD. Figure 3-12 compares annual average GPCD rates for the large municipal providers. The GPCD rate for the AMA large providers shows an upward movement in the 1980s, most likely due to disproportionate growth in the non-residential sector. In the early 1990s, a downward trend is evident, probably due to growth in the residential sector. An upward trend begins in 1993 and continues to the present, which may be reflective of the unusually hot years.

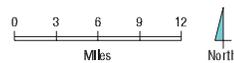


- AMA
- Hardrock
- Highways and Roads
- CAP Canal
- Rivers and Streams
- Counties

Figure 3- 11

Large Municipal Providers

ORIGINAL SOURCE
Arizona Department of Water Resources
Geographic Information System



3.2.2.1.1 Municipalities

In the Pinal AMA, there are two large providers that are municipalities. These providers are the City of Eloy and the Town of Florence.

3.2.2.1.1.1 City of Eloy

The City of Eloy is located along Interstate 10 in the growth corridor between Phoenix and Tucson. It was founded in 1902 when the Southern Pacific Railroad built a switch near Picacho, which they named Eloy. The city, incorporated in 1949, covers nearly 60 square miles of the Eloy Subbasin, but the developed portion of the city covers only approximately two square miles. The 1990 U.S. Census population of the city was 7,211. The 1995 population, calculated from data contained in the city's Annual Water Withdrawal and Use Report (annual report) to the Department was 7,502.

Eloy lies in one of the state's most fertile agricultural areas, with more than 100,000 irrigable acres on which cotton, grains, vegetables and citrus are produced. Cattle ranching, truck stops, and light manufacturing are also important to the area. Local industries include: Skydive Arizona, Glasstile West, Marley Cooling Towers, Hasa Chemical, Arizona Wood Preservatives, and Western Fiberglass.

The City of Eloy delivers water to the developed portion of the city and several outlying communities within its corporate limits, entailing a service area of roughly 12 square miles. The water distribution system has been in place since 1949, and the city is currently in the process of replacing the aging system, which consists of about 40 miles of piping. The city owns four wells and utilizes two of them year-round to meet municipal demand.

3.2.2.1.1.2 Historic Water Use

Eloy's 1995 groundwater use was 1,770 acre-feet, and it used 559 acre-feet of CAP water. Population growth and an aged water distribution system have contributed to an increase in water use over the last 15 years. The water use level has begun to stabilize during the last several years, after peaking in 1990 (see Figure 3-13). The population of the service area has increased by nearly 17 percent since 1985, and water use has increased by nearly 6 percent.

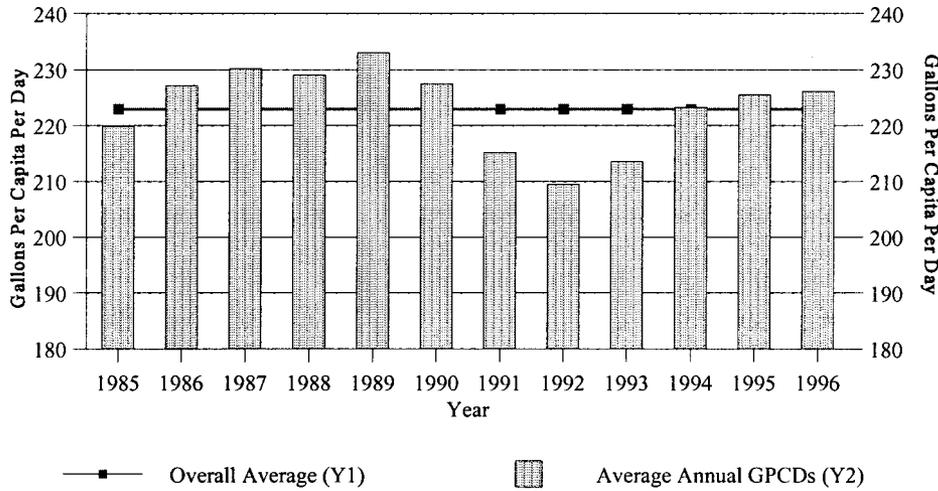
3.2.2.1.1.3 Water Use Patterns and Trends

Municipal water demand is largely a function of population. However, since 1985, the amount of lost and unaccounted for water in the City of Eloy service area has often contributed to an increase in total water use, accounting for 26 percent of the total water use in 1991 and 34 percent of the total in 1995. The city has plans to upgrade the water distribution network, but delays are common due to lack of resources. Because of disproportionate growth in the non-residential use sector and problems with high percentages of lost and unaccounted for water, the city has been regulated under the Alternative Conservation Program since 1994.

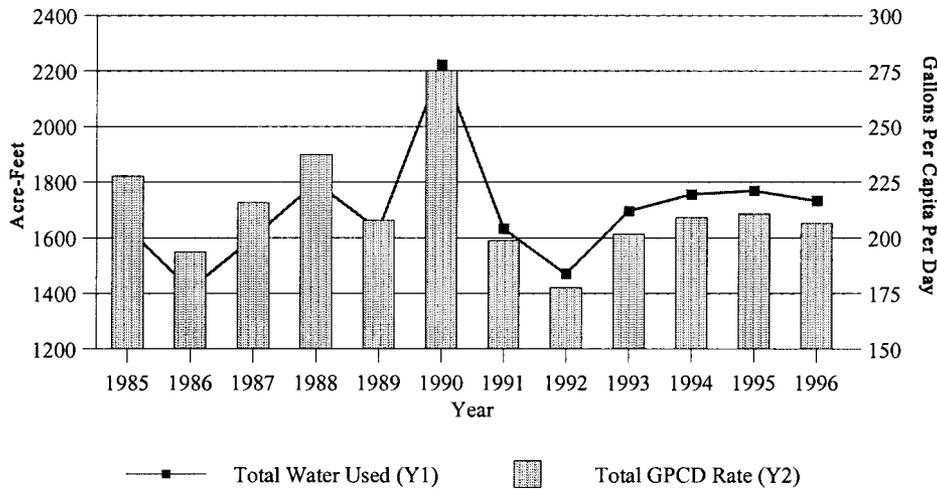
The City of Eloy has an allocation of 2,171 acre-feet of municipal CAP water, of which approximately 500 acre-feet has been used annually to meet the needs of the city's municipal golf course, which was constructed in the early 1990s. The city has applied for a Designation of Assured Water Supply, which should lead to increased use of its CAP allocation.

The City of Eloy has a .5 million gallons per day (mgd) wastewater treatment facility that is currently being expanded to 2.5 mgd. The annual effluent discharge of 560 acre-feet is currently being used to irrigate farmland.

**FIGURE 3-12
AVERAGE GPCD RATES FOR LARGE MUNICIPAL PROVIDERS
1985-1996
PINAL ACTIVE MANAGEMENT AREA**



**FIGURE 3-13
CITY OF ELOY WATER USE AND GPCD RATES
1985-1996**



3.2.2.1.2 Town of Florence

The Town of Florence is located within the Eloy Subbasin, approximately midway between Phoenix and Tucson. The town was staked and platted in 1866 by Colonel Levi Ruggles. Florence has been the Pinal County seat since 1875 and was incorporated in 1908. The 1990 U.S. Census population of the town was 7,510. The 1995 population of the town's service area, calculated from data contained in the town's annual report to the Department, was 4,537. It should be noted that the 1995 population does not include those portions of the town's population served by either the Arizona State Prison - Florence Complex or the Town of Florence - North System.

As county seat, Florence is home to the Pinal County government complex, which employs 1,500 people. The town is also home to the Arizona State Prison - Florence Complex, which employs 1,700 people. Local agricultural products include cotton, grains, and grapes. Cattle are also raised on ranches in the vicinity of Florence.

The Town of Florence, which has served municipal water since the late 1800s, delivers water to customers within its corporate boundaries and adjacent subdivisions to the south and west. The service area is roughly three square miles. The current distribution system consists of 36 miles of piping. Florence uses three wells to serve its municipal customers.

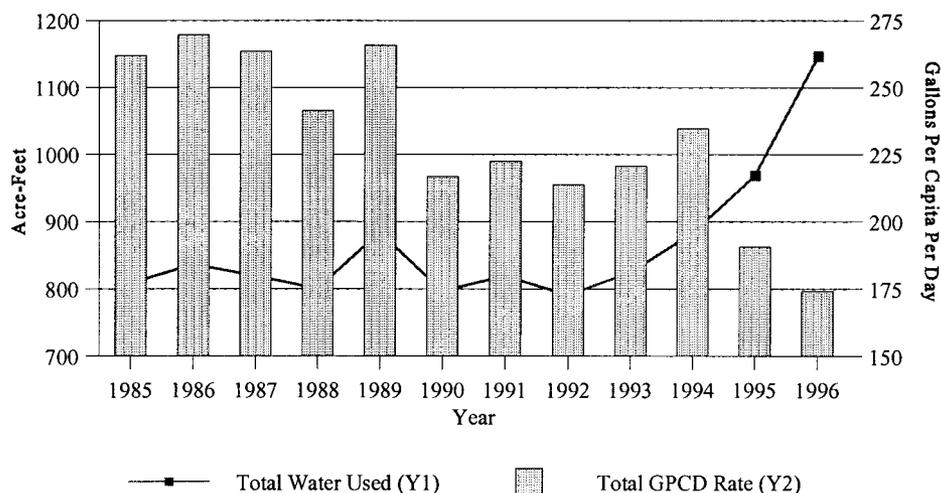
3.2.2.1.2.1 Historic Water Use

Total water use in 1995 for the Town of Florence was 969 acre-feet, which represents an increase of 18 percent from 1990. Residential and non-residential water uses were 537 and 350 acre-feet, representing 45 and 36 percent of the total use respectively. The town's lost and unaccounted for water was just over eight percent. These rates reflect a reversal of an earlier trend of water use starting in 1985, when the residential and non-residential rates were 74 and 22 percent respectively. Overall water use has increased in the last few years, corresponding to population growth, which has gone up significantly over the last several years (see Figure 3-14).

3.2.2.1.2.2 Water Use Patterns and Trends

Similar to other water providers in the Pinal AMA, the Town of Florence relies on groundwater to meet its water needs. The town has a municipal CAP allocation of 2,048 acre-feet, but no CAP water is currently being used. The town, however, has applied for a Designation of Assured Water Supply, which should lead to use of its CAP allocation. The Town of Florence owns two wastewater treatment plants with a combined capacity of nearly two mgd. The 840 acre-feet of annual effluent discharge from the Town of Florence facility is currently being used on farmland. The 113 acre-feet of annual effluent discharge from the Town of Florence - North System facility is used in part to water a private golf course, while nearly 44 acre-feet of excess effluent was recharged during the winter months of 1995 at the town's underground storage facility.

**FIGURE 3-14
TOWN OF FLORENCE WATER USE AND GPCD RATES
1985-1996**



3.2.2.1.3 Private Water Companies

In the Pinal AMA, there are two large municipal providers that are private water companies. These providers are both owned by the Arizona Water Company (AWC) but run as separate systems: the AWC - Casa Grande system and the AWC - Coolidge system.

3.2.2.1.3.1 Arizona Water Company - Casa Grande System

The AWC - Casa Grande system is located in the Eloy Subbasin, serving water to the City of Casa Grande and several nearby communities. The 1990 U.S. Census population of the service area was 26,400. The 1995 population of the service area, calculated from data contained in AWC's annual report to the Department, was 30,228.

Deliveries to the City of Casa Grande account for the bulk of water use in the service area. Casa Grande was founded in 1879 and was named for the well known Hohokam Indian ruins to the northeast. Located about midway between Phoenix and Tucson, Casa Grande was incorporated in 1915 and is the largest community in the Pinal AMA.

Casa Grande is no longer dependent on only mining and agriculture to sustain its economy. The area has evolved and diversified, and is now home to industries including manufacturing, retail trade, government, and tourism. Businesses including Mulay Plastics, Lexington Safety Components, Palm Harbor Homes, Frito-Lay, Abbot Labs, Boral Lifetile, Hunter Douglas Wood Products, American Beverage, Mitsui Components, Hexcell, Mayville Metals, and Velcro Laminates operate from the Casa Grande area. The city is also home of two factory outlet centers located along Interstate 10.

Prior to 1987, AWC provided water to the area through three separate distribution systems: Casa Grande, Arizona City, and Lake in the Desert. In 1987, these systems were physically integrated and designated as the AWC - Casa Grande system. The service area for the Casa Grande system now covers about 55 square miles, and the distribution system consists of nearly 346 miles of piping. AWC operates the system by using 11 active wells.

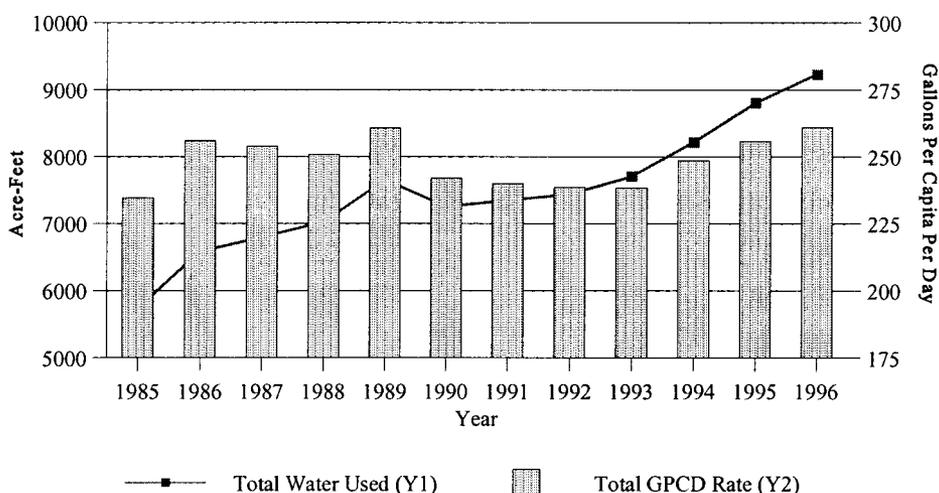
3.2.2.1.3.2 Historic Water Use

The AWC - Casa Grande system used 8,704 acre-feet of groundwater in 1995. Population growth and corresponding expansion of the service area have resulted in increased total water use. The overall use of water has increased by nearly 38 percent since 1985. In 1996, residential water use accounted for almost 50 percent of the total water use, while non-residential use made up 42 percent, with the balance classified as lost and unaccounted for water. Between 1985 and 1990, residential use increased at a much faster rate than non-residential, but between 1993 and 1996, the growth rate for non-residential use has been 10 percent higher than the rate for residential use. The demand for water is expected to increase in response to both population and rapid economic growth (see Figure 3-15).

3.2.2.1.3.3 Water Use Patterns and Trends

AWC meters all deliveries for its Casa Grande system except water used for main flushing, fire hydrant testing, and fire-fighting, which are estimated by time and known discharge rates. A drive-by survey of various new residential developments, conducted by Pinal AMA staff, revealed that less than one-third of the homes were landscaped with turf, and the rest used partial turf and low-water use landscaping. Older and lower-income residences in the city are typically landscaped with mostly turf.

**FIGURE 3-15
ARIZONA WATER COMPANY
CASA GRANDE WATER USE AND GPCD RATES
1985-1996**



The AWC - Casa Grande system is currently dependent on groundwater to meet the area's water demand. In response to an increasing water demand, groundwater withdrawals have shown a consistent steady climb since 1986. The average yearly increase is slightly more than three percent which closely parallels the average population increase for the same time frame.

AWC has an allocation of 8,884 acre-feet of municipal CAP water for its Casa Grande system. Except for roughly 200 acre-feet delivered annually to a private golf course, AWC is currently not using its CAP allocation.

The City of Casa Grande owns the sewage system and operates a 4.0 mgd wastewater treatment plant, which discharged 2,464 acre-feet of effluent in 1995. Much of the effluent is delivered to the city's municipal golf course, whose turf is now entirely watered by effluent. The remaining effluent is delivered to nearby farmland for irrigation purposes.

3.2.2.1.3.4 Arizona Water Company - Coolidge System

The AWC - Coolidge system is located approximately halfway between Phoenix and Tucson in the Eloy Subbasin and supplies water to the City of Coolidge, the unincorporated community of Valley Farms, and surrounding areas to the south of Coolidge. The 1990 U.S. Census population for the service area was 8,205. The 1995 population of the service area, calculated from data contained in AWC's annual report to the Department, was 8,381.

Deliveries to the City of Coolidge account for the majority of water use within the service area. Coolidge was founded by R. J. Jones in 1925 following the completion of Coolidge Dam on the Gila River. Both the city and the dam were named after President Calvin Coolidge. Coolidge Dam resulted in the area being transformed into rich farmland. The city was incorporated in 1945 and is located in the commercial center of Arizona's cotton industry.

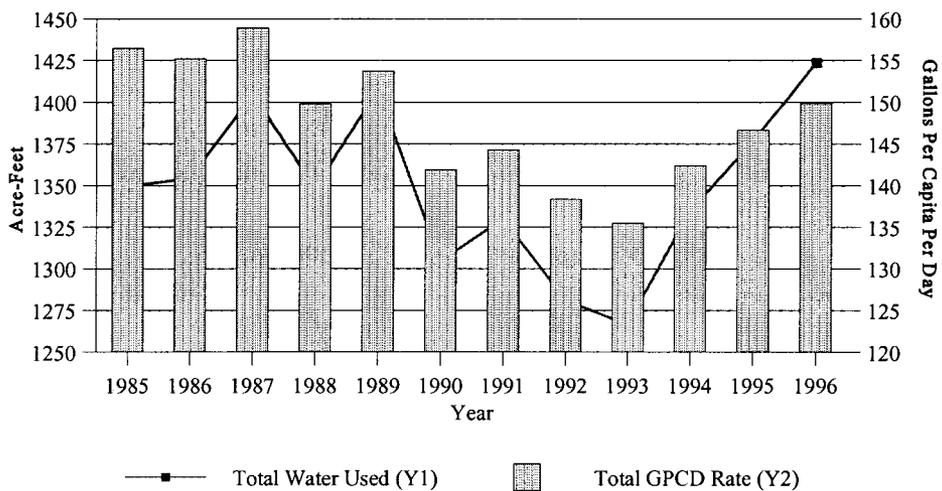
The economy of Coolidge, once dependent on agriculture, has diversified to include manufacturing, tourism, and government-related employment such as the Arizona Training Program and Central Arizona College.

The service area for the AWC - Coolidge system is nearly eight square miles, while the incorporated area of the City of Coolidge is about four square miles. The water distribution system consists of about 60 miles of piping. AWC operates the system by utilizing five active wells.

3.2.2.1.3.5 Historic Water Use

Total water use for the AWC - Coolidge system in 1995 was 1,377 acre-feet, which represents about five percent growth since 1990 (see Figure 3-16). Data from the annual reports indicate that the population has increased at an annual rate of slightly over one percent between 1985 and 1990, while the rate between 1990 and 1995 was slightly over two percent. With the exception of two sharp changes in water use, due to weather variation in 1987 and 1989, water use had been slightly declining until recent years.

**FIGURE 3-16
ARIZONA WATER COMPANY
COOLIDGE WATER USE AND GPCD RATES
1985-1996**



3.2.2.1.3.6 Water Use Patterns and Trends

The service area for the AWC - Coolidge system consists mainly of older, single family homes and commercial development along State Highway 287. Landscaping is predominantly turf, although new developments utilize low water-use landscaping. Schools, parks, and several subdivisions receive water for landscape watering purposes from SCIDD. It should be noted that this water use is not included in the total water use or GPCD rate for the system.

AWC has a 2,000 acre-feet municipal CAP allocation for its Coolidge system. The allocation is presently is not being utilized.

The City of Coolidge owns and operates the sewage system and a wastewater treatment plant with a 0.8 mgd capacity. In 1995, the facility discharged 560 acre-feet of effluent. The effluent is currently being used to irrigate nearby farmland.

3.2.2.1.4 Institutional Providers

For the first management period, special providers were defined as entities supplying more than 60 percent of their total non-irrigation deliveries to non-residential uses, and whose water use patterns could not be adequately characterized by an overall per capita rate. Special providers were assigned mandatory conservation requirements, including a maximum residential GPCD requirement. The Pinal AMA had three special providers: the Arizona State Prison - Florence Complex, the Arizona Training Program, and Central Arizona College.

For the second management period, the special provider status was replaced by an institutional provider classification. Providers must supply a minimum of 90 percent of their non-irrigation deliveries to specific non-residential users in order to receive institutional provider status. Currently, there are two institutional water providers in the Pinal AMA: the Francisco Grande Resort and Golf Club and the Arizona State Prison - Florence Complex. In 1995, the two institutional providers used 2,104 acre-feet of groundwater.

3.2.2.2 Large Untreated Water Providers

The Department has defined large untreated water providers as providers delivering untreated water for non-irrigation uses through a distribution system separate and distinct from that used to deliver treated water. Large untreated water providers either annually deliver 100 acre-feet or more of untreated (non-potable) water, or serve 500 or more customers. Some large untreated water providers supply untreated water for both irrigation and non-irrigation uses through a common distribution system. The most common non-irrigation use is the watering of lawns and small pastures that are under two acres in size.

There are two large untreated water providers in the Pinal AMA: SCIDD and the City of Casa Grande's Evergreen Irrigation District (EID). SCIDD delivers mostly surface water from the Gila River mixed with some groundwater to 17 subdivisions, schools, and parks, Casa Grande, Coolidge, and Florence. In 1995, SCIDD delivered 612 acre-feet for non-irrigation purposes. EID delivers groundwater for landscape watering purposes to about 50 single family residences in one of Casa Grande's older neighborhoods. EID's 1995 deliveries totaled 123 acre-feet.

3.2.2.3 Individual Users

Individual users are entities served water by cities, towns, or private water companies, to which specific conservation requirements apply. These conservation program requirements are contained in Chapter 6. Individual users include turf-related facilities (golf courses, schools, parks, cemeteries, and common areas of housing developments), large-scale cooling facilities, and landscaped public rights-of-way. In the Pinal AMA, individual users are primarily limited to turf-related facilities. The AMA currently has 21 turf-related facilities, of these 14 are individual and non-regulated users receiving water from a municipal provider. In 1995, 803 acre-feet of municipal water was delivered to turf-related facilities, which accounted for approximately four percent of the municipal water deliveries. Becoming designated as an individual user relieves the water provider from enforcing the specific conservation requirements that pertain to that user. Although, the provider is still accountable for the water delivered to an individual user.

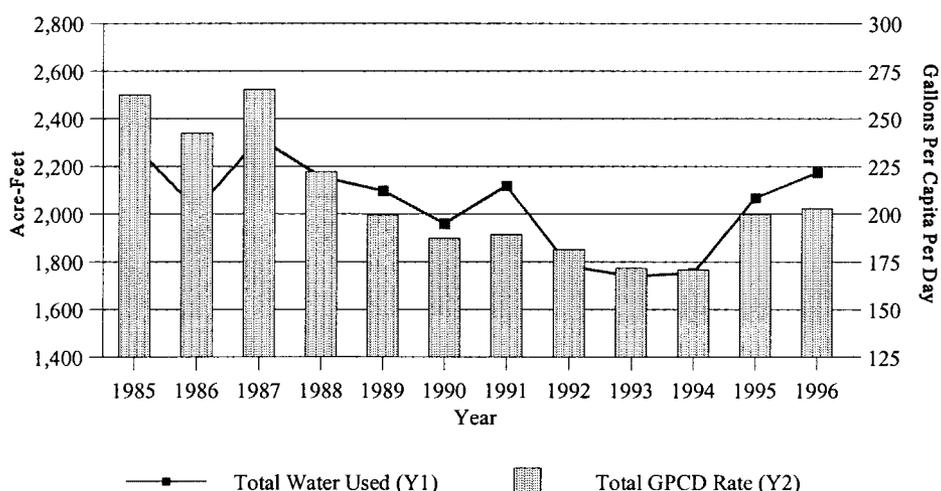
3.2.2.4 Small Municipal Providers

There are currently 23 small municipal providers in the Pinal AMA. Several small providers are mobile home parks with very stable populations and virtually no potential for growth. Other small providers serve small subdivisions and are not expected to expand once build-out occurs. However, some of the small providers do have potential for growth and have been growing at a steady rate for several years. In 1995, there were 22 small providers in the AMA, and their total water use was 2,068 acre-feet. Water use by

small providers, as a whole, generally decreased between 1987 and 1994 but has shown an upward trend since that time (see Figure 3-17).

The population for the small providers was estimated using the average occupancy rate and persons per household figures from the 1990 U.S. Census as a base population. Then, for each consecutive year, the number of housing units served by the small providers, as reported on their annual reports, were tallied and the occupancy rates and person per occupied housing unit applied. The 1985-1995 average GPCD rate for the small providers in the Pinal AMA was 207. Based on the available data, however, the average annual GPCD rate for individual small providers fluctuates widely over time. This may be due to rainfall affecting exterior water use by their customers. In addition, the data collected from the small providers are generally not as accurate as the information collected from the large providers in the AMA.

**FIGURE 3-17
SMALL PROVIDER WATER USE AND GPCD RATES
1985-1996
PINAL ACTIVE MANAGEMENT AREA**



3.2.3 Industrial

Industrial water users pump groundwater from their own wells pursuant to a Type 1 or Type 2 non-irrigation grandfathered right or a groundwater withdrawal permit. All of these water rights and permits have annual allotments associated with them. Industrial users are subject to conservation requirements, which are described in Chapter 6. All industrial users have general conservation requirements. In addition, the following industrial users have specific conservation requirements:

- Turf-Related Facilities (≥10 acres)
- Sand and Gravel Facilities (>100 acre-feet/year)
- Metal Mining Facilities (>500 acre-feet/year)
- Large-Scale Power Plants (>25 megawatts)
- Large-Scale Cooling Facilities (>1,000 tons)
- Dairy Operations (monthly average 100 lactating cows/year)
- Cattle Feedlot Operations (monthly average 100 beef cattle/year)
- New Large Landscape Users (>10,000 square feet)
- New Large Industrial Users (>100 acre-feet/year).

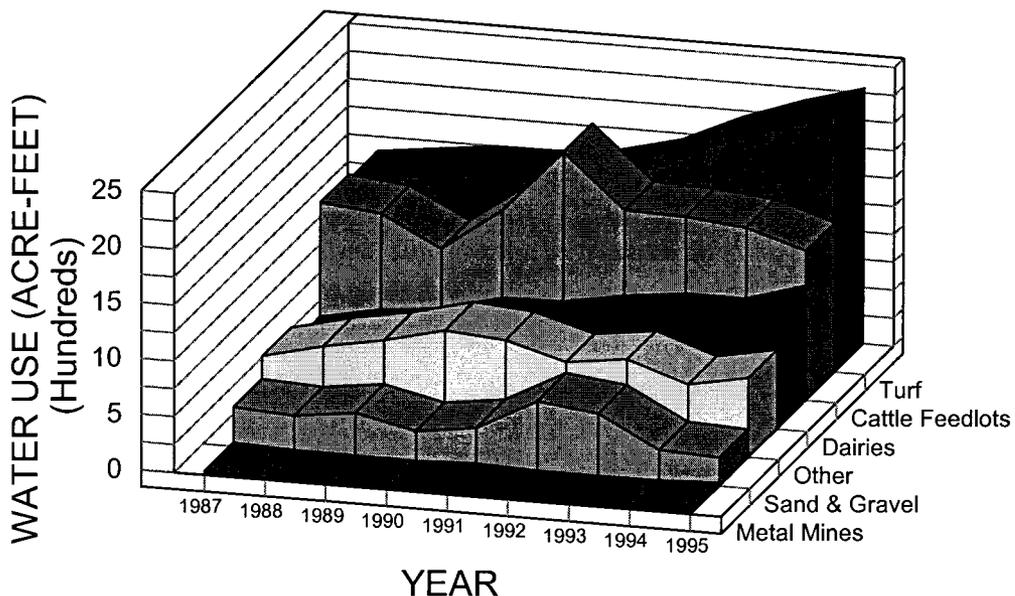
Industrial users in the Pinal AMA currently use considerably less water than they are entitled to pursuant to their annual allotments. The total allotment associated with the AMA’s industrial sector is nearly 32,000

acre-feet per year, not including emergency dewatering and hydrologic testing permits. This amount does reflect allotments for turf-related facilities that receive water from municipal providers and turf-related facilities that are classified as non-regulated users.

The difference between the allotment and actual use is partially explained by the process used to establish Type 2 grandfathered rights. Allotments for Type 2 grandfathered rights were based on the highest pumpage year between 1975 and 1980. Industrial water use is associated with production levels, which, in some cases, were high during this period, and which can vary widely in response to economic conditions. Additionally, some industrial users have ceased operations entirely, although they have retained their Type 2 grandfathered rights.

Figure 3-18 shows water use trends for the period of 1987-1995 for the major industrial water user categories in the Pinal AMA. As indicated, water use by most of the industrial categories has remained relatively stable over this period except for use by turf-related facilities, which is indicative of golf course construction. In 1995, industrial facilities in the AMA used a total of 7,693 acre-feet of water, which was less than one percent of the AMA's total water use for that year. It should be noted that this total also includes water used by turf-related facilities that are individual users, while Figure 3-18 shows only water used by those facilities with water rights and permits. Table 3-5 shows the number of industrial facilities by user category, associated water rights and permits, and amounts of water used in 1995. Turf-related facilities are the AMA's largest industrial category, accounting for 4,285 acre-feet in 1995. Of this amount, 31 percent, or 1,326 acre-feet, was used by industrial right holders and 69 percent, or 2,959 acre-feet, was used by facilities served by municipal providers. The next two largest industrial categories in the AMA are cattle feedlots and dairies. In 1995, cattle feedlots used 1,334 acre-feet, while dairies used in excess of 1,000 acre-feet. Currently, there are no large-scale power plants, new large landscape users, new large industrial users, or identified large-scale cooling facilities in the AMA. Figure 3-19 shows the location of the larger industrial water users in the AMA.

**FIGURE 3-18
TRENDS IN INDUSTRIAL WATER USE
1987-1995
PINAL ACTIVE MANAGEMENT AREA**



**TABLE 3-5
INDUSTRIAL WATER RIGHTS AND USE SUMMARY, 1995
PINAL ACTIVE MANAGEMENT AREA**

User Category	Type of Water Right or Permit	Number of Facilities	Water Allotments (acre-feet)	Water Use (acre-feet)
Cattle Feedlots	Type 2	17	5,740	1,334
Turf-Related Facilities	Type 1 & Type 2; General Industrial Use (GIU) Permit	7	1,876	1,326
Dairies	Type 1 & Type 2; GIU Permit	9	1,391	1,030
Sand & Gravel	Type 2 - Mineral Extraction; Mineral Extraction Permit	6	3,491	253
Other Industrial >100 acre-feet	Type 1 & Type 2; GIU Permit	11 ¹	7,782	326
Other Industrial <100 acre-feet	Type 1 & Type 2; GIU Permit	86 ¹	1,467	386
Miscellaneous ²	N/A	1	N/A	50
Metal Mines	Type 1; Dewatering & Mineral Extraction Permits	6	7,784	29
SUBTOTAL			29,531	4,734
Turf - Individual & Non-regulated Users ³	Service Area	14	3,043	2,959
TOTAL			32,574	7,693

¹ Number of water rights and permits.

² Interim CAP water delivered to Picacho School by CAIDD.

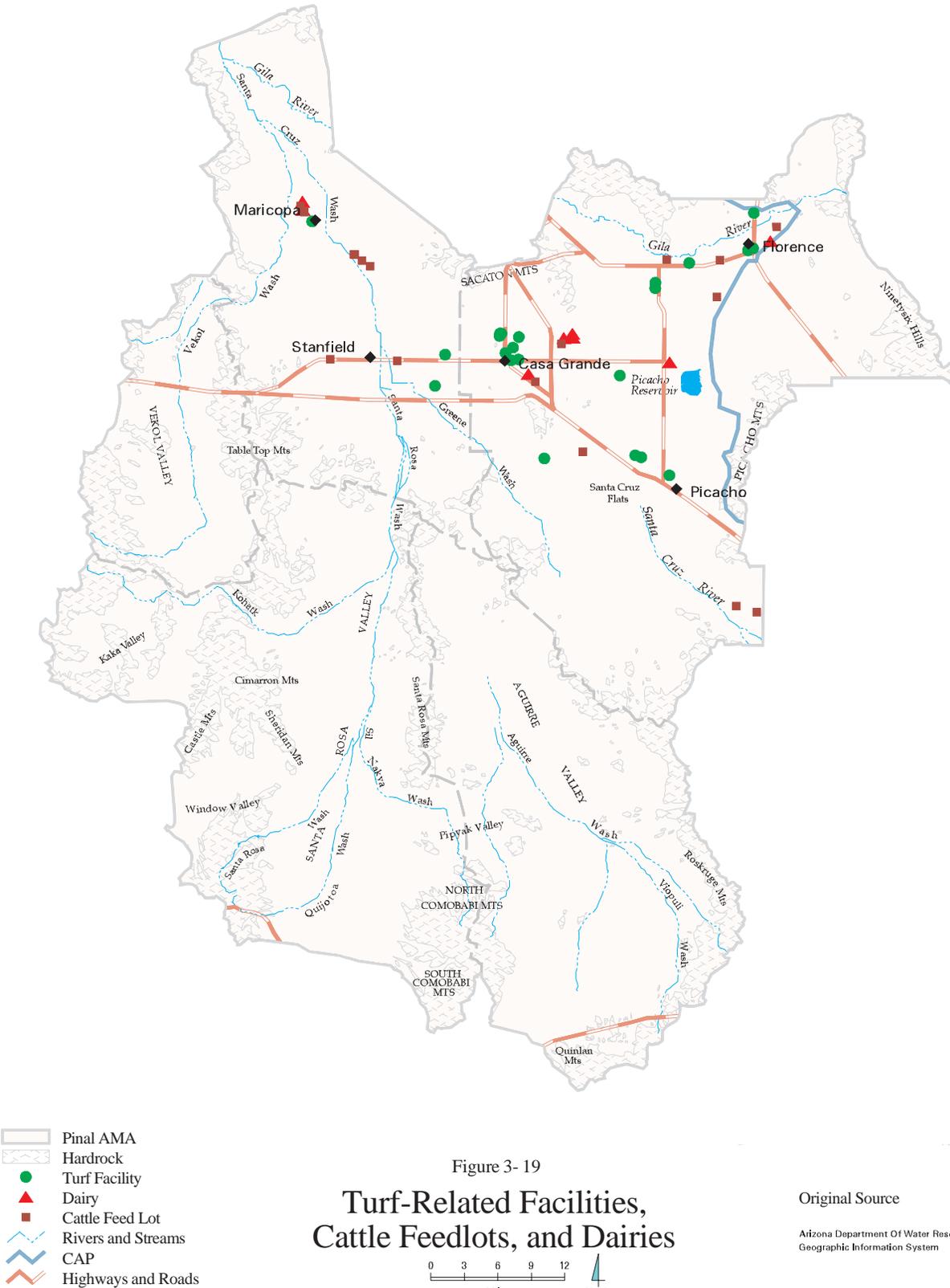
³ The municipal golf courses for the City of Casa Grande and the City of Eloy are counted as municipal uses and classified as Non-regulated Users due to their use of 100 percent renewable water supplies.

3.2.3.1 Turf-Related Facilities

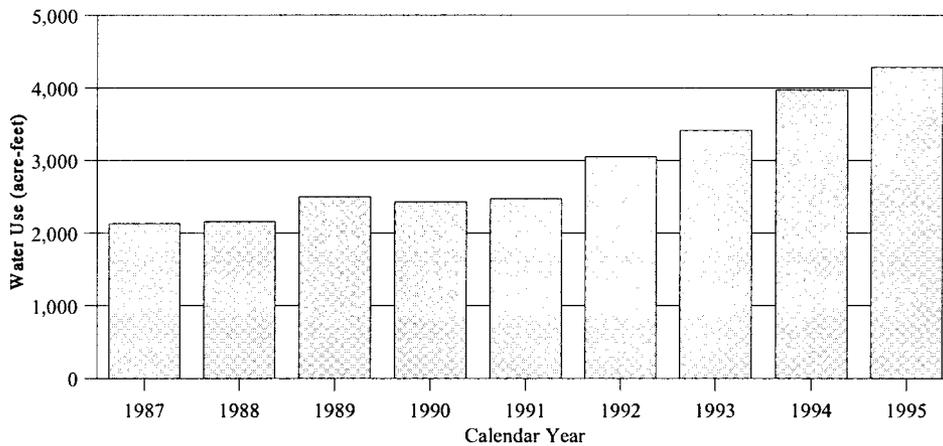
3.2.3.1.1 Overview of Turf-Related Facilities

As previously mentioned, turf-related facilities are the largest industrial water user category in the Pinal AMA, historically representing about 50 percent of total industrial water use. Four new turf-related facilities have been built since 1987. While two of these new facilities are schools, the trend of increasing water use is mostly due to new and expanding golf courses (see Figure 3-20).

Average turf application rates in 1995 for the different types of turf-related facilities in the Pinal AMA varied from less than 3.0 to 6.5 acre-feet per acre per year (see Table 3-6). This range indicates that a broad spectrum of water use patterns exists among turf-related facilities.



**FIGURE 3-20
WATER USE TRENDS IN TURF-RELATED FACILITIES, 1987-1995
PINAL ACTIVE MANAGEMENT AREA**



**TABLE 3-6
TURF-RELATED FACILITIES, 1995
PINAL ACTIVE MANAGEMENT AREA**

Facility		Acreage			Water Application	
Type	Number	Turf	Bodies of Water	Low Water Use Plants	Water Use (AF)	Application Rate (AF/AC) ¹
Golf Courses	6	483	66	19	2,095	3.4
Non-regulated Users ²	2	205	26	0	1,502	6.5
Common Areas	1	5	13.75	0	105	4.0
Schools	12	208	0	0	583	2.8
TOTAL	21	902	106	19	4,285	4.0

¹ Average application rates were derived by subtracting the estimated water use for bodies of water and low water use landscaped areas from the reported 1995 water use and dividing by the number of turfed acres reported on 1995 annual reports.

² The municipal golf courses of Casa Grande and Eloy are exempt from reporting to the Department but are shown to give a more accurate representation of the number of AMA facilities and their water use.

3.2.3.1.2 Water Supplies

Water demand for turf-related facilities is met through various supply sources, including:

- Groundwater pumped pursuant to Type 1 and Type 2 grandfathered rights
- Groundwater pumped pursuant to general industrial use permits
- Groundwater served by municipal water providers
- Effluent served from municipal wastewater treatment plants
- CAP water served through a municipal water provider.

In 1995, 53 percent of the turf-related facility demand was served by water rights and permits, while 47 percent was served through municipal providers (see Table 3-7).

**TABLE 3-7
WATER USE BY TURF-RELATED FACILITIES, 1995
PINAL ACTIVE MANAGEMENT AREA**

Type	Number of Facilities			Water Use (acre-feet)							
	Muni.	Indust.	Non-Reg. User ¹	Municipal				Industrial			
				GW	CAP	SW	Effluent	GW	CAP	SW	Effluent
Golf Courses	3	3	2	676	816	0	63	904	0	0	1,139
Common Areas	0	1	0	0	0	0	0	105	0	0	0
Schools	9	3	0	335	0	107	0	141	0	0	0
TOTAL	12	7	2	1,011	816	107	63	1,150	0	0	1,139

¹ Non-regulated Users are exempt from reporting to the Department but are shown to give a more accurate representation of water use for the AMA.

GW = groundwater
SW = surface water

3.2.3.1.3 Facility Use Characteristics

3.2.3.1.3.1 Golf Courses

There are eight golf courses in the Pinal AMA. In 1995, they used nearly 3,600 acre-feet of water, or about 84 percent of water use by turf-related facilities. Golf course water use by industrial right holders was 1,081 acre-feet in 1995, or about 20 percent of all industrial water demand. Golf course demand has grown since 1987, and five new courses have been built. This user group historically represents 40 percent of industrial water demand.

Four golf courses used effluent in 1995, one of which used effluent exclusively. While the Department encourages the use of effluent, rising prices and limited availability due to distribution constraints make the wide-spread use of effluent problematic.

In 1995, the average water application rate for turfed areas on regulated golf course was 3.4 acre-feet per acre. Application rates for golf courses tend to be higher than those of other turf-related facilities because of concerns about playability and appearance.

3.2.3.1.3.2 Common Areas

Common areas are characterized as recreational or open space areas associated with housing developments that contain 10 or more acres of water-intensive landscaping. In general, these areas are a combination of turfed areas and water bodies (lakes). Appearance is an overriding concern for common areas. As a result, turfed areas are typically overseeded and have relatively high water application rates. The one regulated common area in the Pinal AMA contains 5 acres of turf and nearly 14 acres of lakes. In 1995, the facility used 105 acre-feet of water, with a turf application rate of 4.0 acre-feet per acre.

3.2.3.1.3.3 Schools

The main function of turf in school yards is to provide an appropriate surface for active play. Turf appearance is not as major a concern for schools as it is for golf courses and common areas. School managers have determined that using low water application rates can save money without adversely

impacting use. The application rate for schools in the Pinal AMA was 2.8 acre-feet per acre. No schools overseed their turf in winter, and common bermuda is the only grass used.

Water application systems at schools are usually relatively inflexible. Newer facilities have in-place heads with manual or elector-mechanical control. Some schools have converted non-play areas to drip irrigation. Due to budget constraints, it is difficult for schools to install computerized controllers, and systems are frequently manually operated.

The 12 schools with water-intensive landscaped areas large enough to be classified as turf-related facilities used 583 acre-feet of water in 1995, accounting for 11 percent of the industrial water demand. In 1995, 141 acre-feet, or 24 percent, of school demand was met through water rights. Industrial right holder use by schools has remained within a consistent range since 1987. School acreage is comparatively small, with nine facilities less than 20 acres in size. None of the schools regulated as turf-related facilities in the AMA receive effluent for turf watering. One of the schools, however, does receive surface water from SCIDD for such purposes.

3.2.3.2 Cattle Feedlots

The cattle feedlot industry is largely dependent on the market price of beef. The price of beef, cattle feed, and weather conditions all affect the water use at feedlot facilities. Water use at feedlots is measured in gallons per animal per day (GAD). Cattle feedlots in the Pinal AMA typically use about 13 GAD. In 1995, water use by the 17 cattle feedlots in the AMA was 1,334 acre-feet.

3.2.3.3 Dairies

Dairy operations are a small but growing industrial category in the Pinal AMA. In 1995, there were nine dairies in the AMA. These dairies hold water rights and permits, with a combined annual allotment of nearly 1,400 acre-feet. In 1995, water use by the dairies was about 1,000 acre-feet. Dairy water use has been steadily increasing since 1989, due in large part to the relocation of dairies from the Phoenix AMA to the Pinal AMA.

3.2.3.4 Other Industrial Users

Many different types of commercial and manufacturing water users are included in this industrial category. The largest other industrial users in the Pinal AMA include an automotive test track and a manufacturer of building materials. Water uses commonly include cooling, landscaping, sanitary, kitchen and industrial process uses. Water use for this category was 712 acre-feet in 1995.

3.2.3.5 Sand and Gravel Facilities

Since 1987, annual water use by sand and gravel operations in the Pinal AMA has ranged from nearly 200 acre-feet to more than 600 acre-feet. Average annual usage has been approximately 345 acre-feet. Water use in 1995 by these facilities was 253 acre-feet.

3.2.3.6 Metal Mines

Water use by metal mines in the Pinal AMA has been generally static for years. Water use by metal mines was 29 acre-feet in 1995.

3.3 BASELINE WATER BUDGET

The following baseline water budget (Table 3-8) summarizes the characteristics of Pinal AMA water demand and supply for 1995. Water demand, along with the amounts and sources of supply that were used to satisfy demand, are separated in this budget by water use sector. Additional demands include transfers of water from the AMA to other basins, lost and/or unaccounted for water from canals, and water which is diverted or withdrawn pursuant to riparian enhancement projects. In 1995, the only additional demand in the AMA was from canal losses.

Groundwater overdraft in this budget is calculated by subtracting net groundwater inflow, stream channel recharge, and incidental recharge from the total groundwater withdrawn. Natural recharge to aquifers in the Pinal AMA from groundwater inflow was assumed on the basis of the most recent analysis of AMA groundwater conditions using the hydrologic model described in Chapter 2. Stream channel recharge resulting from intermittent flooding of the Gila and Santa Cruz rivers, while variable, averages 20,000 acre-feet per year. The assumptions used to estimate incidental recharge resulting from the losses incurred by the agricultural, municipal, and industrial water use sectors are described in Chapter 11. It should be noted that the amount of CAP water that is stored in-lieu of groundwater withdrawn is stored water that might be recovered at some future date.

The baseline water budget shows that water use in the Pinal AMA is dominated by irrigated agriculture. In 1995, the AMA's total water demand was 1,129,723 acre-feet. Non-Indian agricultural water demand comprised 74.7 percent; Indian agriculture, which includes minor municipal uses, comprised 12.9 percent; municipal and industrial water demand was 2.4 percent; additional demands (canal losses) were 5.9 percent; and underground storage demand was 4.1 percent. The total water demand was supplied with about 40 percent groundwater and 60 percent renewable water supplies.

Groundwater overdraft in 1995 was 119,908 acre-feet, or approximately 11 percent of the AMA's total water demand.

3.4 FACTORS THAT MAY INFLUENCE FUTURE GROUNDWATER USE

3.4.1 Agricultural

3.4.1.1 Socio-economic

3.4.1.1.1 Water Costs

Water costs have been and are expected to continue to be the largest single factor affecting groundwater use in the Pinal AMA. Currently, CAWCD's target pricing program is scheduled to end in 2003. If this program is not extended, and CAP water costs escalate, the utilization of CAP water in the AMA would be considerably reduced. If CAP incentive pricing is not continued and crop prices remain favorable, future groundwater usage in the AMA could revert to pre-CAP conditions.

3.4.1.1.2 Crop Patterns

Water use in the Pinal AMA has been historically driven by world market conditions for crops such as cotton and small grains. Regional and local markets for alfalfa and other forage crops also impact water use, but to a much lesser degree. In the future, little change is expected in crop patterns in the AMA. It is anticipated, therefore, that water use will continue to fluctuate based upon regional and world market conditions.

**TABLE 3-8
 PINAL ACTIVE MANAGEMENT AREA BASELINE WATER BUDGET
 1995 WATER CONDITIONS (IN ACRE-FEET)**

NON-INDIAN AGRICULTURE	
Demand	844,207
Supply	844,207
CAP (Direct Use)	298,671
SCIP (Surface Water)	150,047
Santa Cruz River	1,480
Effluent	4,274
Groundwater (In-lieu)	46,983
Groundwater	342,752
INDIAN AGRICULTURE	
Demand	145,510
Supply	145,510
CAP (Surface Water)	76,345
SCIP (Surface Water)	30,818
Salt River Project (Surface Water)	4,953
Effluent	5,231
Groundwater	28,163
MUNICIPAL	
Demand	21,115
Supply	21,115
CAP (Surface Water)	835
SCIP (Surface Water)	558
Effluent	62
Groundwater	19,660
INDUSTRIAL	
Demand	5,697
Supply	5,697
CAP (Surface Water)	50
Effluent	1,139
Groundwater	4,508
UNDERGROUND STORAGE	
Demand	46,983
Supply	46,983
Indirect Recharge	46,983
Direct Recharge	0
ADDITIONAL DEMANDS	
Demand	66,211
Basin Transfers	0
Canal Losses	66,211
Seepage	50,790
Evapotranspiration (ET)	15,421
Riparian Enhancement	0
Supply	66,211
CAP (Surface Water)	8,458
SCIP (Surface Water)	49,524
Groundwater	8,229
TOTAL DEMAND	1,129,723
TOTAL GROUNDWATER WITHDRAWN	450,295
NET GROUNDWATER INFLOW	38,300
Groundwater Inflow	50,100
(Less) Groundwater Outflow	11,800
STREAM CHANNEL RECHARGE	20,000
TOTAL INCIDENTAL RECHARGE	272,087
EXTINGUISHMENT OF STORAGE CREDITS	0
GROUNDWATER OVERDRAFT	119,908

3.4.1.1.3 Cultural Practices

Most farms in the Pinal AMA have a long history of producing cotton. Growers have made significant investments in specialized equipment for growing cotton and will thus continue to produce the crop as their major farm product. Therefore, it is expected that cotton will remain the major crop in the AMA well into the future.

3.4.1.2 Institutional and Legal Constraints

3.4.1.2.1 Federal Agriculture Improvement and Reform Act (FAIR)

In 1996, FAIR deregulated farming through a phaseout of crop restrictions and payments. All payments will end in fiscal year 2002. Acreage may be planted in any crop (except fruits and vegetables), any combination of crops, or left idle. The acreage must be maintained in an agricultural or related activity.

The effects of FAIR on the agricultural community during the third management period are not known. However, with the elimination of crop restrictions, there could be a change in cropping patterns and/or increased cropped acreage, thereby increasing water use.

3.4.1.2.2 Reclamation Reform Act (RRA)

A long recognized impediment to increased use of agricultural CAP supplies in the Pinal AMA has been the RRA, which established strict requirements for irrigation districts and farmers receiving benefits from federal irrigation projects such as the CAP. CAP irrigation districts are prohibited from delivering CAP water to ineligible acreage. Therefore, RRA provisions have forced irrigation districts to deliver groundwater or indirect recharge water to farmlands even though CAP water has been available. In MSIDD and CAIDD, each district may pump up to 30,000 acre-feet in meeting its general distribution requirements and to serve lands that are ineligible to receive CAP water under the provisions of the RRA. If indirect recharge supplies are curtailed in the future, the irrigation districts will have little choice but to deliver groundwater to ineligible acreage resulting in an increased use of this supply.

3.4.1.2.3 Indian Water Right Settlements

The on-going adjudications process is an issue that may affect groundwater use and supplies in the Pinal AMA. The Gila River Indian Community is a party to the Gila River General Stream Adjudication, along with many other claimants. The adjudication process will establish a final decree that will mandate the surface water rights of the Indians, as well as the other claimants. The Gila River Indian Community is engaged in settlement discussions that have not yet concluded with an agreement. When an agreement is reached and approved by the courts, it is expected to have considerable impact on non-Indian agricultural water use in the AMA. A settlement could involve reducing available CAP water supplies, groundwater pumping limitations, and extinguishment of storage credits.

3.4.1.2.4 Recharge Programs

Development of recharge programs are important to the augmentation strategy for the Pinal AMA. Typically, such programs store water through direct recharge of the aquifer or through an indirect process where groundwater pumping is curtailed in exchange for use of a renewable water supply. Renewable supplies are most often obtained through either CAWCD or the Arizona Water Banking Authority. Groundwater usage in the AMA could increase significantly if the cost of indirectly recharging water becomes greater than the cost of pumping groundwater.

3.4.1.2.5 Retirement of Farmland

To a limited extent, retirement of farmland within the Pinal AMA during the third management period is expected to occur. Retirement of farmland can occur several different ways: urbanization, conversion of an IGFR to a Type 1 grandfathered right, or extinguishment of an IGFR. Retirement of farmland is not anticipated to cause a significant reduction in agricultural water use in the AMA. However, urbanization will displace agriculture in and around the AMA's four incorporated municipalities. Some of the agricultural market demands will be assimilated by other farmland not currently in production.

In addition to urban retirement of agricultural lands, the City of Mesa owns approximately 11,000 acres of irrigated farmland in the Eloy Subbasin that may be retired in the future. The Department has approved Mesa's development plan with respect to retiring its farmland for non-irrigation use. In the event that this farmland were to be fully retired, Mesa would be able to withdraw approximately 30,000 acre-feet of groundwater annually and exchange it for CAP water to be used within its service area in the Phoenix AMA. However, it is not anticipated that Mesa will retire the land prior to 2025.

3.4.1.2.6 Irrigation District Pumping Limitations

In response to CAP debt restructuring, the two largest CAP irrigation districts within the Pinal AMA have agreed to groundwater pumping limitations. Generally, MSIDD and CAIDD will restrict their annual groundwater pumping to 250,000 and 240,000 acre-feet respectively. Each district will also further reduce its groundwater pumping by the amount of one acre-foot for each acre-foot of CAP water made available to the district, at usable times, at a cost not exceeding the total cost of pumping groundwater in the district plus 10 percent, up to a maximum reduction of 100,000 acre-feet. Both districts also have strict limitations on the amount of groundwater that may be pumped near the boundaries of neighboring Indian reservations. In the event that CAP water supplies become too costly to purchase, these groundwater pumping limitations may be greater limiting factors than the Department's Third Management Plan conservation requirements.

3.4.1.2.7 Deregulation of the Electric Industry

In the Pinal AMA the major cost component of operating a well is the purchase of electricity. With the expected deregulation of the electric industry, the future cost of electricity is uncertain. If electricity rates were to significantly rise, then the use of renewable water supplies would increase because the cost of these supplies would be more competitive with the cost of groundwater. However, if electric rates decline, groundwater use in the AMA would increase.

3.4.1.3 Physical

3.4.1.3.1 Availability of Water Supplies

The groundwater supply in the Pinal AMA is considered adequate for future needs because there is approximately 31 million acre-feet in storage that is available for use by all water users in the two principal subbasins.

The physical supply of CAP water is not considered to be a significant problem for agriculture in the future. The cost of this supply, however, may restrict its future use. Also, water demands of CAP districts during hot summer months could result in peak water supply problems due to canal capacity constraints. If the use of CAP water is lessened due to cost or distribution problems, then the use of groundwater for irrigation purposes could increase.

Surface water supplies from the Gila River, pursuant to the Globe Equity Decree, are adequate to meet future water demands associated with SCIDD, except during periods of drought. SCIDD is expected to continue to supplement its surface water deliveries with groundwater withdrawals. Groundwater pumping could increase if surface water supplies are disrupted or if a drought occurs.

Effluent production during the third management period for the Pinal AMA is expected to continue to increase as the municipalities grow. Although agriculture is expected to use some of these supplies, they are being used increasingly for non-irrigation purposes, such as watering golf courses.

3.4.1.3.2 Water Quality

Water quality in the Pinal AMA is not expected to be a limiting factor for agriculture in the future. There are no significant water quality problem associated with groundwater or any renewable water supplies in the AMA.

3.4.2 Municipal

3.4.2.1 Socio-economic

It is anticipated that municipal water use in the Pinal AMA will steadily increase as the current patterns of urbanization continue. However, there is potential of large-scale residential developments occurring in the AMA similar to those of the Phoenix and Tucson metropolitan areas. Should these developments occur, municipal use could increase much more rapidly than projected.

The flat rate structures historically used by municipal providers in the Pinal AMA do not encourage water conservation. However, a change to a conservation-oriented rate structure is not anticipated in the future.

Overall public awareness of the need for water conservation is increasing in the Pinal AMA and may lead to greater water conservation by municipal providers in the future.

3.4.2.2 Legal and Institutional

In addition to the requirements of the Third Management Plan's Municipal Conservation Program, other regulations and policies are expected to impact future municipal water use. These include, but are not limited to:

- The Department's Assured Water Supply Rules for the Pinal AMA may lead to increased use of municipal CAP allocations if providers elect to pursue an assured water supply designation.
- The rate and financing constraints imposed by the ACC on private water companies are not experienced by public water utilities. Historically, the ACC has not supported rate changes which would allow for the recovery of costs associated with water conservation programs or development of more expensive water supplies such as CAP water.
- CAWCD policies, particularly those regarding the pricing of CAP water, impact providers with CAP allocations. The capital charges for municipal CAP allocations are increasing dramatically. In 1994, these charges were \$11.00 per acre-foot. They are currently \$48.00 per acre-foot of water and are expected to increase to \$54.00 per acre-foot in 2000. Capital charges must be paid regardless of whether or not any CAP water is used. Consequently, it will be increasingly difficult for providers to retain their allocations, without finding ways to put them to use.

- Recharge programs adopted by the Pinal County Water Augmentation Authority (PCWAA) can directly influence municipal water use. All of the large providers in the Pinal AMA are members of PCWAA and have indicated their desire to recharge all or a portion of their CAP allocations.

3.4.2.3 Physical

Some municipal providers in the Pinal AMA are currently using aging distribution systems that have excessive leaks, malfunctioning water meters, and other problems. It is anticipated that these providers will upgrade their systems to reduce water loss. Efforts to integrate and expand distribution systems are also expected to occur in the future in response to municipal growth.

Groundwater supplies are generally available for municipal use throughout the Pinal AMA. All large providers in the AMA also have CAP allocations. In addition, effluent supplies will continue to increase as municipalities grow. These renewable supplies are expected to become important alternative water sources for new turf-related facilities, especially golf courses, served by municipal providers.

In general, water quality does not adversely affect municipal use in the Pinal AMA, nor is it expected to in the future. In isolated areas, most particularly in the Maricopa-Stanfield Subbasin, groundwater supplies will require treatment for excessive nitrate concentrations prior to municipal use.

3.4.3 Industrial

3.4.3.1 Socio-Economic

Historically, turf-related facilities have been the largest industrial water user in the Pinal AMA. The number of turf-related facilities is expected to increase in the future as a result of the demands of a growing population. Therefore, future water demands of turf-related facilities are also expected to increase and this industrial category remain as one of the largest industrial users of water. It is anticipated that many of the golf courses that will be constructed in the AMA will use renewable supplies, especially effluent.

Dairies are also a major industrial water user that is expected to grow in the future. Low land costs, a strategic location between major metropolitan areas, and continuing urbanization within the Phoenix AMA are expected to continue to make the Pinal AMA attractive for relocating dairies. With this expansion, water use by this industrial category is expected to steadily increase.

Although there are currently no large-scale power plants in the Pinal AMA, it is anticipated that one will be constructed in Casa Grande in the near future. The proposed facility will be powered by natural gas and produce up to 500 megawatts of electricity. The facility's annual water demand is expected to be nearly 4,000 acre-feet. Initially, most of this demand is expected to be met by municipal CAP water allocated to the AWC - Casa Grande system. Effluent from the City of Casa Grande's wastewater treatment plant will also be used. As the city grows and the supply of effluent increases, it is anticipated that more effluent and less CAP water will be used.

Other industrial water users in the Pinal AMA are expected to use water at current levels or exhibit only modest increases in water use.

3.4.3.2 Physical

Groundwater supplies for industrial use are generally available throughout the Pinal AMA. There are no industrial CAP allocations in the AMA. Currently, the only industrial users that utilize renewable water supplies in the AMA are turf-related facilities. These supplies are primarily delivered to individual users served by municipal providers.

In order to more fully utilize renewable supplies in the future, construction of conveyance systems would be required to obtain CAP water from the nearest canal or effluent from a nearby wastewater treatment plant. However, the costs of these renewable supplies is likely to make their use unattractive to facilities that would otherwise be capable of pumping groundwater at a lesser cost.

Water quality is a concern for a few industrial water users. Some may be unwilling to use CAP due to fluctuations in water quality. Before secondary treated effluent can be used for industrial cooling processes, it generally requires pretreatment to remove salts and other constituents.

3.5 CONCLUSIONS

This chapter has presented the characteristics of 1995 water use in the Pinal AMA for the four main water use sectors: non-Indian agriculture, Indian agriculture, municipal, and industrial. The 1995 water use provided a baseline for projecting future water use in the AMA through 2025. In addition, factors that may affect future water use have been introduced. These factors are used in Chapter 11 to project water use for the four sectors.